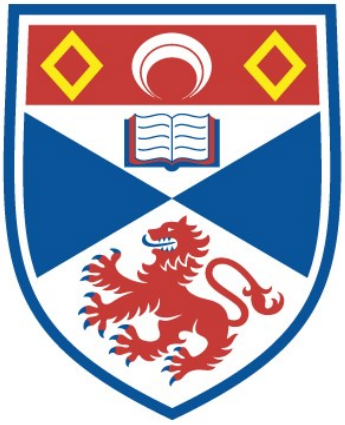
ANCIENT WEATHER SIGNS:
TEXTS, SCIENCE AND TRADITION

Michael Ian Beardmore

A Thesis Submitted for the Degree of PhD
at the
University of St Andrews



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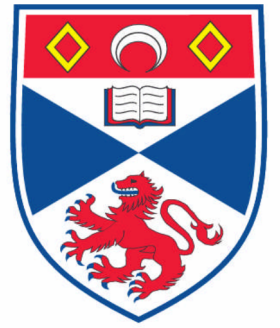

This thesis is submitted in partial fulfilment for the degree of PhD
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September 2013

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Finally, I dedicate this thesis to two enthusiastic supporters of academic pursuits, Bill Hurst and Joyce Over. Their immeasurable influence on me continues.

Thesis Abstract

This thesis offers a new contextualisation of weather signs, naturally occurring terrestrial indicators of weather change (from, for example, animals, plants and atmospheric phenomena), in antiquity. It asks how the utility of this method of prediction was perceived and presented in ancient sources and studies the range of answers given across almost eight hundred years of Greek and Roman civilisation. The presentation of weather signs is compared throughout to that of another predictive method, astrometeorology, which uses the movement of the stars as markers of approaching weather.

The first chapter deals with the presentation and discussion of weather signs in a range of Greek texts. It sees hesitant trust being placed in weather signs, lists of which were constructed so as to be underpinned by astronomical knowledge. The second chapter assesses how these Greek lists were received and assimilated into Roman intellectual discourse by looking to the strikingly similar practice of divining by portents. This lays the foundations for the final chapter, which describes and explains the Roman treatment of weather signs. Here, the perceived utility of weather signs can be seen to reduce rapidly as the cultural significance of astronomy reaches new heights.

This thesis provides new readings and interpretations of a range of weather-based passages and texts, from the Pseudo-Theophrastan *De Signis*, to Lucan's *Pharsalia*, to Pliny's *Natural History*, many of which have previously been greatly understudied or oversimplified. It allows us to understand the social and scientific place of weather prediction in the ancient world and therefore how abstract and elaborate ideas and theories filtered in to the seemingly commonplace and everyday. I argue that between the 7th century BC and the end of the 1st century AD, the treatment of weather signs changes from being framed in fundamentally practical terms to one in which practical considerations were negligible or absent. As this occurred, astrometeorology comes to be seen as the only predictive method worthy of detailed attention. These two processes, I suggest, were linked.

Ancient Weather Signs: Texts, Science and Tradition

Contents

Introduction and Preliminary Questions

The weather has always been an unavoidable part of life. It continues to shape activities and decisions as much now as it did three thousand years ago. It is perhaps due to this constant presence and our deep-seated familiarity with it that it has been overlooked as a scholarly topic. This thesis focusses on discussions and depictions of a particular weather prediction method in ancient writing, that of using weather signs, and attempts to describe a history of its presentation.

By asking how their perceived utility is depicted, it will describe the changing relationship between weather signs and another method, astrometeorology, which "uses the motions of stars as signs for predicting the weather and for tracking the seasons",[1] to argue that between the 7th century BC and 1st century AD, the treatment of weather signs changes in such a way as to demonstrate increasing doubt over their ability to act as predictors of the weather. As this occurred, astrometeorology developed to be portrayed as the only predictive method worthy of serious attention. This linked two-way process engaged a sometimes surprising array of the greatest thinkers, philosophers and poets of antiquity.

Through this study, weather signs will become contextualised in a way they have not been thus far in modern scholarship. Asking questions about their perceived utility and the reasons behind this perception can reveal much about, for example, the uneasy place they had in ancient scientific discourse, the extent to which weather prediction was bound up in the dialogue of status and knowledge, and how elaborate ideas and concepts could interact with, and be seen through, the seemingly commonplace and 'everyday'. Thus the texts studied in this thesis can be seen to both reflect and contribute to ancient discussions of man's understanding of nature.[2]

1. Thesis Scope and Structure

In order to do this, I would suggest that the history of weather signs in antiquity is most usefully thought of as being made up of four broad periods, with some overlap between them, based on the presence of similar attitudes and ideas in the texts within each period. The first spans the Archaic period, from the composition of Hesiod's *Works and Days* to around the 5th century BC, and can be characterised by its blending of natural

[1] Lehoux (2007) 5.
[2] Editions of texts used throughout are those cited in the bibliography. Translations, unless otherwise stated, are my own.

and astronomical signs, with divisions between predictive methods being absent. In the second period, from the fifth century through to the end of the first half of the 1st century BC, we do find division between astrometeorology and weather signs and this is fundamentally a time of trust in the use of weather signs, though, as I will demonstrate, it is also the period in which questions begin to be asked about their operation, reliability and accuracy, and the importance of astrometeorology starts to emerge. We can see this in the *De Signis* and Aratus' *Phaenomena*. The third period, containing the second half of the 1st century BC and the 1st century AD sees a rapid decline in the level of trust in weather signs. Astrometeorology becomes by far the most prominent method here, as demonstrated by Columella's *De Re Rustica* and Pliny's *Natural History*. The fourth period, from the 2nd century AD onwards sees weather signs employed primarily as interesting pieces of information, largely devoid of practical information or setting. This can be seen in Aelian's *On Animals*. There is some effort in this period to view and discuss them within the scope of recent astrologically-inspired theories,[3] but this appears to have been short lived.

For two reasons, only the first three of these periods will be discussed in this thesis. Firstly, this thesis is particularly interested in the changing way weather signs are presented as practical weather predictors. As I will show, the degree to which weather signs are depicted as such reduces during the period covered by the thesis, and thus, this 'fourth period' offers very little in the way of weather signs in a practical context. Secondly, the first three periods, I will demonstrate, represent those of the greatest change in weather prediction and the relationship between weather signs and astrometeorology, and thus deserve the immediate detailed scholarly attention. I will, however, indicate within the footnotes points and patterns which hint at, or feed into, the later reception in the 2nd century AD and beyond.

This thesis is made up of three chapters. The first is a study of the first two periods, and therefore deals with almost exclusively Greek material. The third chapter deals with the third, largely Roman period. The second part deals with the Roman reception of Greek texts and representations of weather signs. My intention here is not, of course, to draw any wide-ranging ethnic distinctions between the two, but simply to acknowledge the differing social and cultural contexts from which the bulk of evidence

[3] See Ptolemy's *Tetrabiblos* II.13.

relevant to this thesis comes.[4] There is, as we shall see, a great deal of continuity and contact between these two, but some differentiation is necessary.

In Part 1, we will see how weather sign and astrometeorology became distinct predictive methods, developing from a rural calendar that initially combined them fluently. The functions natural signs serve will be seen to change, as the roles they were once described as performing are subsumed by astronomical disciplines. I will argue that astronomy increasingly underscored weather signs and that this is reflected in the structure of weather sign lists of these periods. This represents the beginning of the process of ancient authors suppressing weather signs in favour of astrometeorology. I will suggest that the Greek understanding of the nature of meteorological phenomena, growing intellectual concerns over the ability to explain weather prediction methods, and an interest in the accuracy of predictions were all substantial factors in this process. Hesiod's *Works and Days* will form our starting point, and will be used to understand the state of Archaic Greek astronomy and the agricultural use of natural signs. The Pseudo-Theophrastan[5] *De Signis*, a text with early peripatetic 4th century BC origins, which lists approximately 200 weather signs for various types of weather, and Aratus' 3rd century didactic poem *Phaenomena* will be the focus of the majority of attention here. These texts will be set against the background of wider meteorological issues evidenced from Aristotle's *Meteorologica*, as well as other texts from the Aristotelian corpus, including the Aristotelian *Physiognomica*, which provides signs for judging peoples' characters. It is occasionally compared to the *De Signis*[6] owing to the fact that they are both essentially lengthy lists but, as I will demonstrate, differences in the disciplines make the parallel far from perfect, and Epicurus' *Letter to Pythocles*. Apollonius' *Arognautica* and Theocritus' 22nd *Idyll* will help us to understand what literary depictions of weather prediction can reveal about attitudes towards them. Finally, Geminus' *Isagoge*, a prose introduction to astronomical matters written in the 1st century BC, will provide us with some vital insights into list-ordering and an otherwise lost text. We will also frequently call upon the parapegma included in that text.

[4] Much in the same way as, for example, Lehoux (2012) 5, who reads Galen as fundamentally 'Roman' as a way of "draw[ing] attention to the historical, social, and cultural loci".
[5] The authorship of the *De Signis* has been in debated since antiquity. Cronin (1992) and Sider and Brunschön (2007) 40-3 provide the main arguments and issues on this topic. For ease, I will refer throughout simply to the 'author of the *De Signis*'.
[6] See Sider & Brunschön (2007) introduction, but especially pp. 35; 37; 42. On ancient physiognomics generally, see Barton (1994b) 95-131 and p.101 on this Aristotelian treatise.

In Part 2, I will argue that Roman intellectuals adopted weather signs as a subject for academic discourse in a particularly Roman way. By comparing and conflating them with their long-held rituals of prophesying through portents, the Romans found ways to talk about, depict, and understand weather signs. I will also suggest, however, that Greek weather sign texts influenced how Romans wrote about portents. Here, Cicero's *De Divinatione* will be our main piece of evidence, with support from Vergil's *Georgics* and Pliny's *Natural History.* Aratus' *Phaenomena* will be seen to play an important role in this process.

Part 3 will concentrate on Roman prediction, primarily in the 1st centuries BC and AD. It will argue that during this period, weather signs were increasingly depicted as an impractical technique for predicting the weather, giving way to astrometeorology. Again, I will suggest a number of reasons for this decline. In particular, the growth of the sophistication and utility of astronomy will be an important persistent undercurrent throughout. It underscored the Julian Calendar reform, which I will argue was as much about meteorology as it was about time-keeping, and saw astronomy becoming a marker of elite education and social status. Weather signs thus became associated with the dubious word of the rural. I will also propose that the issue of explanation was as present in Roman writings as it was in the Greek and, in fact, frequently took its lead from the uncertainties of the Greek discussion. Once again, Cicero's *De Divinatione* and Vergil's *Georgics* will provide important evidence here, along with Cato's *De Agricultura*, Columella's *De Re Rustica* and book 18 of Pliny's *Natural History*. It will also feature discussion a of a text which has had its authorship and date questioned, a fragment of poetry by Quintus Cicero, and a text about whose authorship and date I will bring into doubt, the *Aratea* of Germanicus. Perhaps somewhat surprisingly, Lucan's *Pharsalia* will also loom large in this chapter. It will also consider evidence for the Julian Calendar reform such as Varro's agricultural writing, Ovid's *Fasti*, and the archaeological remains of the Horologium Augusti. Many of the texts in this thesis will be discussed alongside a number of parapegmata, both inscriptional (that is, the stone tablets inscribed with specific cycle of events, set alongside a series of consecutive bored holes, through which a peg is moved) and literary (in which events are indexed a series of dates or fixed occurrences, such as stellar phases, in lieu of holes and pegs).

In order to do any of this, however, we must first have some idea of how a weather sign was defined and how the two methods, weather signs and astrometeorology, differed from one another.

2. Divisions in Ancient Predictive Traditions

In his 2007 book, Daryn Lehoux makes the observation that in the ancient world, there appear to have been "two more-or-less distinct traditions of weather prediction".[7] The first, which he calls the 'Theophrastan' tradition, after the supposed author of our longest extant weather sign list, the *De Signis*, "uses rules of thumb and day-to-day observations like the croaking of frogs" and is characterised by the fact that these observations can generally be seen as fortuitous and are solely of earthy and atmospheric phenomena. The second tradition is that of astrometeorology, which "uses the motions of stars as signs for predicting the weather and for tracking the seasons". Lehoux went on to suggest that the 'Theophrastan' prediction method and astrometeorology "follow different historical trajectories".[8] On the contrary, I will suggest that the 'trajectories' of the two methods are in fact closely entwined and that organisation of and attitude towards weather signs in the ancient world were closely linked to, and influenced by, the development of astrometeorology and associated astronomical disciplines. As evidence for these two traditions, Lehoux cites only the modern, secondary literature of Taub,[9] Sider[10] and Lehoux himself.[11]

In the same year, David Sider and Carl Wolfram Brunschön published their commentary on the *De Signis*, in which they argue for two main branches of weather prediction based not on the type of sign, like Lehoux, but on the length of time that a prediction covers: "one was calendrical, reminders of the annual revolution of seasons and their associated normal weather. The best signs of this class are the risings and settings of particular stars or constellations, although other annual occurrences, such as the regular passage of migrating birds, were also employed…The second class of observation gave warning of a more immediate sort".[12] Prior to these, Germaine Aujac saw the division as a combination of the two; that there is a fundamental separation between prediction by animals and stars, and within this latter method, a further division between short-term and long-term prediction.[13] These recent examples of scholarship have, then, begun to raise the question of how we are to divide and understand ancient weather prediction. An analysis of the ancient evidence, with the aim of more clearly

[7] Lehoux (2007) 5.
[8] Lehoux (2007) 5.
[9] Taub (2003).
[10] Sider (2002) 292-6.
[11] Lehoux (2004).
[12] Sider and Brunschön (2007) 2-3.
[13] Aujac (2003) 14-5.

defining the traditions, however, is gravely lacking in the scholarship on the history of meteorology, including those cited by Lehoux. I intend to counter this problem here by looking in detail at how, and the extent to which, ancient authors appear to have conceptualised any potential divisions and thus understand what the scope of the 'weather sign' was in antiquity.

We can begin with the *De Signis*. In that text, the author draws a clear dividing line between two types of *sēmeia* by which one can predict the weather and in doing so, outlines the scope of his work. The first type is those taken from the risings and settings of the stars. It is indicated to us that such signs will not be covered in the *De Signis*; if we want them, they must be learned "from astronomers", ἐκ τῶν ἀστρονομικῶν (*DS*.1). The second set of signs appears to be simply a group consisting of everything else; the author of the *De Signis* does indeed refer to them as τὰ λοίπα σημεῖα, "the remaining signs" (*DS*.3). Included in this group of signs, we are told, are not only those taken from animals but also those from the sun and moon (*DS*.5). By at least the time the *De Signis* was written, then, a conscious division between the two methods appears to have been so strong that the two sets of signs seem to be studied and catalogued by different groups of people. Is the division, though, fundamentally one of time, as Sider and Brunschön suggest? I here take, as a sample, one section of the *De Signis* and look at any mention of time-frame so we may assess the suggestion. The section on rain prediction (*DS*.10-25) consists of approximately 100 individual signs. Of these, seven are said to signify rain either on the third day after they have appeared, or within three days.[14] Two signs are longer term, describing the weather in a particular season[15] and one is said to give an indication of "imminent" rain (διὰ ταχέων).[16] All the remaining signs have no time-frame attached to their significance, but presumably indicate weather patterns that will occur in the near future. So although Theophrastus' signs are for the most part short-term, they are not exclusively so – some are seasonally based, which will be discussed later. Not only, then, does some distinction of time-frame not seem to be a central theme, but it is also not expressed in any way in the introduction to the *De Signis*, which is so evidently designed to demonstrate a conceptualised divide between methods.

[14] Red sunrise and red sunset (*DS*.10); sunset into clouds, streaks of light to the south (*DS*.11); silvery moon, fiery moon, cloudy moon (*DS*.12).
[15] Rainy winter leads to dry spring; dry winter leads to rainy winter (both *DS*.24).
[16] Rain likely when Euboia is belted in cloud (*DS*.22).

We witness the same fundamental division in prediction methods in Geminus' *Isagoge* of the 1st century BC.[17] In his section on using the stars to predict the weather (*Isag.*17), Geminus discusses astrometeorology and the problems he sees associated with the idea of stellar causality.[18] He concludes his chapter by stating that one would do just as well to abandon stellar prediction in favour of "signs given to us by nature, such as those that Aratus uses" (σημείοις…τοῖς ὑπὸ τῆς φύσεως ἡμῖν διδομένοις, οἷς καὶ Ἄρατος κέχρηται (*Isag.* 17.46)). Here again, then, there is no evidence that a divide is put in place based on the chronological limitations or specificities of signs; the division is simply that of the stars, and nature.

The same thing can be seen happening in Pliny's *Natural History*. Pliny begins his section on predicting the weather (18.60) in relation to agriculture with what Lehoux classifies as an astrometeorological parapegma.[19] This, an extended account of how to predict weather for specific agricultural activities according to the day and date, we are told, is based on the movements of stars and the periods of seasons (*omnis autem ratio observata est tribus modis, exortu siderum occasuque et ipsorum temporum cardinibus*, "the whole system is based on three modes of observation, the rising and setting of the stars and the periods of the seasons themselves" (*NH*.18.218)). Following this, Pliny turns to his catalogue of other predictive weather signs. Like the author of the *De Signis*, he categorises this group of prognostics signs as simply "the remaining means of forecasting the weather" (*reliqua tempestatum praesagia* (*NH*.18.340)). Again, then, we see a division between an astronomical method and 'everything else'. Also like the *De Signis* author, the vast majority of Pliny's signs have no time-frame attached to them but appear to be short-term. Those that do have a time-frame would generally fall more neatly into Sider and Brunschön's 'annual/seasonal' grouping since they tend to predict the weather of an entire season based on that of another :

> *si ver et aestas non sine refrigerio aliquo transierint, autumnum serenum ac densum minusque ventosum facient. autumni serenitas ventosam hiemem facit.*
>
> "If spring and summer do not pass without a chill, they will cause a calm and misty autumn with less wind. A clam autumn causes a windy winter"
> - *NH*.18.351-2

That Pliny freely mixes the two time-frames, however, would suggest that the division he puts in place is not that noted by Sider and Brunschön, but by Lehoux.

[17] For the problems of dating Geminus, see Evans and Berggren (2006) 15-22.
[18] For more on this, see Lehoux (2007) 158.
[19] Lehoux (2007) 148.

A final, later, text further confirms that thinking about a division between astrometeorology and 'another method' is the right way to be viewing ancient prediction. In the letters of Alciphron, a set of fictitious compositions from the 3rd (?) century AD, there is one imagined epistle, letter 1.10, Κέφαλος Ποντίῳ, in which one fisherman writes to another fisherman about the danger of a violent sea. This letter features a number of references to ways of predicting a rough sea, starting with two of the 'Theophrastan' type, one related to the sky, the other to the actions of dolphins:

> …τὸν οὐρανὸν ὑποβέβηκεν ἀχλὺς καὶ πάντα πανταχόθεν συννέφελα, καὶ οἱ ἄνεμοι δὲ πρὸς ἀλλήλους ἀρασσόμενοι ὅσον οὔπω κυκήσειν τὸ πέλαγος ἐπαγγέλλονται. ἀλλὰ καὶ οἱ δελφῖνες ἀνασκιρτῶντες καὶ τῆς θαλάττης ἀνοιδούσης λείως ἐφαλλόμενοι χειμῶνα καὶ τάραχον ἐπιόντα μηνύουσι.
>
> "…a mist has spread beneath the sky, everything everywhere is clouded over, and the winds, dashing against each other, give warning that they will almost immediately throw the sea into turmoil. Yes, the dolphins too, skipping and leaping smoothly upon the swelling waves, indicate that storm and tumult are upon us."[20]
>
> - Alciphron 1.10.1

The fisherman Cephalus, the fictional author of this letter, then explains another way that a rough sea can be predicted; using the rising of the constellation Taurus:

> Ταύρου δέ φασιν ἐπιτολὴν κατ' οὐρανον οἱ τὰ μετέωρα δεινοὶ τὰ νῦν ἑστάναι.
>
> "The rising of Taurus in the sky, as those say who are skilled in interpreting the heavens, is at this moment impending."
>
> - Alciphron 1.10.2

It is a telling feature of this passage that here, those who use the stars to predict the weather are differentiated from those who do not. Only those who are "skilled in interpreting the heavens" are shown as understanding the significance of the presence of Taurus. Everyone else must rely on their ability to interpret non-astronomical weather signs, like a dolphin leaping around in the waves.[21] We therefore witness the division between the two predictive methods once again and it seems increasingly like Lehoux's division is the accurate one.

Lehoux's distinction between 'earthly and atmospheric' and 'celestial' does not, however, appear to quite define the full meteorological picture. How does he account for those signs that seem to blur the boundaries between the traditions? Lehoux suggests

[20] Alciphron translations by Benner & Fobes (1949).
[21] This differentiation of people through they predictive method they use is something we will see occurring elsewhere too, especially in Pliny's *Natural History*. See pp. 199-200, below, on this.

that the 'Theophrastan' categorisation of signs like haloes around the sun, the changing dimness of certain stars, or the apparent colour of the moon by classifying them as "*atmospheric* rather than *astronomical* phenomena in a strict sense".[22] Lehoux's classification, however, does not seem to find a place for phenomena like comets and shooting stars. In both the *De Signis* and *Natural History*, the sighting of a large number of shooting stars is a sign of wind. This sign is included in Pliny's 'Theophrastan' section, and their inclusion in the *De Signis* indicates that they not classified within the 'astronomical' grouping. To modern audiences, though, they most certainly are astronomical phenomena. How is it, then, that in the ancient world, they came to be included in the 'Theophrastan' tradition?

To attempt to answer this question, it is perhaps worth turning to Aristotle. In his *Meteorologica*, Aristotle defines *meteora* in the following terms:

> ταῦτα δ' ἐστὶν ὅσα συμβαίνει κατὰ φύσιν μέν, ἀτακτοτέραν μέντοι τῆς τοῦ πρώτου στοιχείου τῶν σωμάτων, περὶ τὸν γειτνιῶντα μάλιστα τόπον τῇ φορᾷ τῇ τῶν ἄστρων…
>
> "Everything that happens naturally, but with a regularity less than that of the primary element of material things, and which occur in the region which borders most closely on the movements of the stars…"
>
> - *Mete*. 1.1 (338b1-2)

Meteorology is defined here by three key characteristics: (1) the phenomena are natural (2) they take place in the sub-lunar sphere and importantly, (3) they occur with a "regularity less than that of the primary element". These final two characteristics need to be placed within the context of the Aristotelian geo-centric universe for them to be fully understood.

According to Aristotle, the universe is constructed in two defined areas, that above the moon (the 'supra-lunar' sphere), and that below it (the 'sub-lunar' sphere). Everything in the sub-lunar sphere is comprised of a combination of four elements: earth, fire, air and water.[23] Crucially, these elements are capable of changing into one another, according to the properties they possess.[24] Everything including and above the moon is comprised of a fifth element, aither, which in the above passage is referred to as the "primary element", and are embedded in a series of concentric spheres, which rotate

[22] Lehoux (2007) 5.
[23] The elements are the topic of *De Generatione et Corruptione*.
[24] See *De Generatione et Corruptione* II.1-8 (328b26 – 335a24) on the properties of the terrestrial elements.

around the Earth regularly and perpetually.[25] This fifth element, unlike the others, is incapable of change.[26] Aristotle's fundamental split, then, is between the stars, sun, moon etc. which are characterised by their regularity of movement and their composition from the 'primary element', and *meteora*, which are less regular in their movement and appearance and are the product of the sub-lunar elements of earth, air, fire and water. This Aristotelian division may have contributed to demarcating the two methods; one focused on signs from regular movements within the supra-lunar sphere, which would be initially under the study of astronomers, and the other on those signs within the Aristotelian sub-lunar spheres, which are not only less predictable but are physically different from the contents of the supra-lunar sphere. To include shooting stars and comets in the list of 'Theophrastan' signs, then, would require them to be considered *meteora*, which would, as I have already said, strike our modern ears as somewhat odd. Indeed, this may have been the case when Aristotle was writing the *Meteorologica* too.

It is significant that immediately after giving his definition of *meteora*, quoted above, the first four examples he gives of the type of phenomena covered in his treatise are those that would seem, to the average observer, to be celestial in nature: the milky way, comets, shooting stars and meteors. It is as if Aristotle is deliberately bringing to his readers' attention the terrestrial nature of these phenomena in particular. Indeed, as further evidence of the potential interpretation of these as celestial, when discussing comets in particular, Aristotle must first dispel the theories of the Pythagoreans, Anaxagoras, Democritus, Hippocrates and Aeschylus, all of whom suggest that comets are either planets or are derived from the planets.[27] In fact, Aristotle argues, such things are clearly products of the sub-lunar sphere.

Shooting stars and meteors are caused by vaporous and hot and dry exhalations produced from sub-lunar elements[28] rising up from the earth and being ignited either by the movement of the celestial sphere (*Mete.*1.4; 341b1 – 341b35) or by heat being forced down when air contracts (341b35- 342a16). The first of these igniting forces produces shooting stars in the upper atmosphere, while the second produces them in the lower atmosphere. Similarly, comets are produced either when a hot, dry exhalation, moved by the celestial motion, becomes sufficiently fiery in form and is then met by an

[25] See *De Caelo* 1 and 2.
[26] *De Caelo* 1.3 (269b18 – 270a35).
[27] *Mete.* 1.6 (342b25- 3344a4).
[28] On exhalations in Aristotle's *Meteorologica*, see pp.62-3 below.

exhalation from below (344a9-344a33) or they are an optical phenomenon, during which the movement of a particular star or planet has caused an exhalation and when viewing it, our sight has been reflected in such a way that the star appears to have a tail as it moves. This tail, though, is independent of the star and is located within the very upper level of the sub-lunar sphere (344a34- 344b12). Thus the seemingly celestial is explained by Aristotle as being firmly terrestrial. The Aristotelian division between the behaviour, composition and characteristics of terrestrial and celestial phenomena is so strong that I think it entirely plausible that it was along these lines that the conceptual division between the methods of weather prediction was cemented. We will also see that Peripatetic authors appear to have had quite a strong interest in weather signs and topics adjacent to them. When talking about 'weather signs', 'terrestrial prediction', 'weather lore', 'prognostics' or similar terms, then, what is being referred to is a body of indicators of forthcoming weather, which includes everything except prediction by the fixed movements of celestial bodies, which is astrometeorology.

Although Aristotle states that meteorological phenomena are considered to be less regular (ἀτακτοτέραν) than their celestial counterparts, we must be careful not to confuse this with being 'irregular'. We will see throughout this thesis that the idea that weather patterns are cyclic is a fundamental and important part of ancient meteorological theory and prediction, and that attempts to understand and 'tame' the weather focus around trying to schematise these cycles. While astrometeorology fits, and supports, this pattern of cyclicity, based as it is around the regular movements of the stars, weather signs would seem to be at odds with it. As Lehoux rightly noted, weather signs can be characterised by their observation and use being "fortuitous";[29] they are, by their very nature, strikingly un-cyclic. This paradox, and how it affects how weather signs are used, presented and viewed will be a central theme throughout, and especially in the Greek chapter. Regularity and reliability was, as we will see, highly valued.

Through discussion of these divisions, I have already begun to place this thesis within the extisting scholarship on ancient meteorology and weather signs. This subject now, however, requires a fuller treatment.

3. Past Weather Sign Scholarship

Serious attention being paid to lists of weather signs began with a series of 22 short articles by E.S. McCartney, published between 1921 and 1934. McCartney placed

[29] Lehoux (2007) 5.

ancient weather signs into fifteen groupings: 1. Animals;[30] 2. Plants;[31] 3. Stars;[32] 4.The Sun;[33] 5.The Moon;[34] 6.Clouds;[35] 7.Rainbows;[36] 8. Weather Galls;[37] 9.Comets;[38] 10.Earthquakes;[39] 11.Signs of Wind;[40] 12.Thunder and Lightning;[41] 13.The Sea;[42] 14.Signs of Hail;[43] and 15.Signs of Drought.[44] McCartney's articles were essentially an exercise in evidence collection and organisation, as a reaction to the fact that Royds' book on Vergil, *The Beasts, Birds and Bees of Virgil*,[45] "shows no special interest in such prognostics".[46] McCartney gathered together and listed every example of each of his groups of weather signs he could find across Greek and Latin literature. Although this process is done with impressive accuracy and thoroughness, he offers very little in the way of interpretive comments, typically pausing only to explain or describe certain meteorological phenomena or to make very basic comparisons, such as the fact that plants appear to be used as weather signs much less frequently than animals.[47] Strikingly, McCartney's work reveals no knowledge of a division in methods between astrometeorology and weather signs, and discusses both parapegmata and atmospheric stellar phenomena within his 'stars' category.

In 1938, William Ernest Gillespie published his recently completed Princeton PhD thesis, *Vergil, Aratus and Others: The Weather-Sign as a Literary Subject.*[48] His stated intention is to "employ an investigation of the development of the weather-sign as a literary subject" in order to determine "the relationship between…various authors of antiquity" [49] from Homer through to the 10th century Byzantine *Geoponica*. By 'relationship' here, Gillespie specifically means which texts have been used as the sources of weather signs for other texts. So, for example, in his closing conclusions, he states that "Pliny the Elder drew upon Aratus, Varro Reatinus, and other sources for his

[30] McCartney (1921a) and (1921b).
[31] McCartney (1924).
[32] McCartney (1926a) and (1926b).
[33] McCartney (1928a).
[34] McCartney (1928b)
[35] McCartney (1929a)
[36] McCartney (1929b) 11-12.
[37] McCartney (1929b) 12.
[38] McCartney (1929b) 12-13.
[39] McCartney (1929b) 13-15.
[40] McCartney (1930b) 22-24.
[41] McCartney (1932a); (1932b); (1932c).
[42] McCartney (1933a); (1933b); (1933c); (1933d)
[43] McCartney (1934a) and (1934b).
[44] McCartney (1934c) and (1934d).
[45] Royds (1914).
[46] McCartney (1921a) 89.
[47] McCartney (1924) 108.
[48] Gillespie (1938).
[49] Gillespie (1938) ix.

weather-signs. There is some evidence for the influence of the Peripatetic school upon Pliny."[50] Gillespie's work employs a methodology of looking for the presence or absence of certain signs as a way of working out, for instance, whether the *De Signis* is the source for Aratus' work, or vice versa. Gillespie's thesis does give us an important indication as to the literary pedigree of, and extent of interest in, weather signs in antiquity but ultimately consigns itself purely to *Quellenforschung*-style source analysis. Thus no external sources outside work explicitly on weather signs are considered; he is interested solely on the textual source tradition of weather sign lists. Gillespie does, however, distinguish between astrometeorology and weather signs as distinct ancient predictive methods.

L.A.S. Jermyn published his article, *Weather-Signs in Virgil: An Attempt to Discover Something of the Poet's Working-Method by Close Examination of Two Passages in* Georgics *I and the Sources on Which They Are Based*, in two parts in 1951.[51] As the title of this piece suggests, source criticism is once again very much at the forefront of Jermyn's analysis. Where Gillespie's interest lay with the transmission of the information contained within specific signs, though, Jermyn is, in addition, concerned with the stylistic similarities between Vergil and Aratus and the 'improvements' Vergil makes, especially regarding use of sound and the level of detail and description provided with each sign. Jermyn is also particularly interested in the truth behind the signs found in both texts – whether their predictions are correct or not, and whether the signs are still in existence today. There is an assumption in Jermyn's paper, also present in Gillespie's work, that Greek weather sign lists could be very easily transplanted from Greek culture to Roman culture and that they were thought about and conceptualised in such similar ways that the Roman authors simply put their own stylistic spin on the lists. By arguing that weather signs actually took root in the Roman intellectual in a very specific, and uniquely Roman, manner, I will question this assumption.

Böker's *Pauly* entry on '*Wetterzeichen*'[52] focusses heavily on astronomical prediction and parapegmata. Böker divides predictive phenomena into two categories: those that are catoptric[53] and those that are not. Why this division is implemented is not clear. Those sections that are relevant to weather signs as discussed in this thesis, for

[50] Gillespie (1938) 64.
[51] Jermyn (1951a) and (1951b).
[52] Böker (1962).
[53] That is, those that are formed from the bending and reflection of light.

example those on haloes or rainbows, are primarily concerned with giving references to where these appear in ancient texts and detailed explanations of the geometry of their appearance. Böker's article also tends towards discussion of later, astrological texts. The section explicitly about weather sign texts, that on '*Diosemeia-Literatur*',[54] concentrates exclusively on source criticism, and exemplifies the assumption that all weather sign texts are formed from purely literary sources, arguing as he does, that all our extant lists are descendants from one *Grundschrift*.

Patrick Cronin's article '*The Authorship and Sources of the* Peri semeiōn' deals with the question of who wrote the *De Signis* and how it was constructed. It is an article which, unlike other weather sign scholarship, does discuss the connection between 'parapegmata'[55] and weather signs. As I will later demonstrate, Cronin is keen to downplay any potential influence that astrometeorology may have had on the *De Signis*. I will argue for quite the opposite: that astrometeorological considerations played a substantial part in the construction of that text. Cronin's arguments will be engaged with closely in the chapter on Greek weather signs.

The comments made at the introduction to the weather sign section of Aratus' *Phaenomena* in Kidd's 1997 commentary[56] reveal where the primary interest of this study lies. Kidd focusses on "a popular tradition of weather lore" and the appearances of weather signs in texts later than the *Phaenomena*, "Virgil's imitation", for example. The emphasis throughout the commentary on lines 758-1141 is thus on correlating the signs that appear in Aratus' poem with those that appear elsewhere, typically quoting a number of parallel examples. As demonstrated above, Kidd calls heavily upon the methodology of present and absent signs, as described above of Gillespie, when discussing Aratus' 'sources'. The nuances of the role weather signs are presented as playing in prediction is never addressed directly, as in many studies, nor how weather sign lists could have been used. Instead, it is deemed sufficient to say that these are weather signs, with the implication being that their application is obvious. It is worth noting here that generally, the astronomical sections of Aratus' *Phaenomena* are overwhelmingly more popular as an area of scholarly interest than the weather signs.

Liba Taub's 2003 study *Ancient Meteorology* is a detailed study of the ancient scientific theories on the weather and associated phenomena. When discussing the

[54] Böker (1962) columns 1611-1613.
[55] Though, as I will show later, Cronin actually means astrometeorology generally, rather than parapegmata specifically.
[56] Kidd (1997). Comments referred to here are on pages 428-9.

dichotomy of ancient prediction, she informs her readers that "here, for the most part, only celestial signs will be considered".[57] Thus throughout her book, Taub, when discussing prediction, focusses on astrometeorology and parapegmata, and deals with weather signs in only a very minor way. Her main interest with them lies in their sense of tradition and the 'echoes' of earlier authors in later ones through weather sign lists. Crucially, as we will see, this book is one of the only places where assumptions about prediction have been challenged and ancient meteorological writing has been contextualised and studied as a on-going, interactive tradition, both of which I intend to build on in this thesis.

A major contribution to the study of weather signs has been made by Sider & Brunschön's commentary on the *De Signis*.[58] This commentary was really the first major work to ask some basic questions about weather signs and their practicalities. I do, however, find myself consistently disagreeing with both their conclusions and methodologies. As I have already argued, I believe the basic division that they chose to establish in ancient prediction, one based on temporal grounds, to be unfounded in ancient evidence.[59] The introduction of the commentary does take in slightly wider issues, such as the practical application of weather signs, but I find their ideas generally too narrowly-focussed around only weather signs and weather sign texts. They argue for the impracticality of the *De Signis* based primarily on problems they find with the structure of that text.[60] Their hypothesis for the use of weather signs is, however, indicative of the inward-looking nature of scholarship on weather signs, working as they do solely with the assumption that weather sign lists always depict the signs as operating as a stand-alone method. I will argue that, in fact, the reality is quite the opposite. Similarly the process of cross-referencing the appearance of signs with earlier and later examples, just as Kidd and Gillespie and McCartney had done before them, looms large in their comments.

As has already been demonstrated, Daryn Lehoux's *Astronomy, Weather and Calendars*[61] has proved an important work in re-establishing the division between weather signs and astrometeorology as the main methods of weather prediction in the ancient world. A book fundamentally about astrometeorology and the development of the parapegma, it discusses weather signs only to establish this divide.

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[57] Taub (2003) 27.
[58] Sider & Brunschön (2007).
[59] See above, pp. 5-11.
[60] See Sider & Brunschön (2007) 36-7, with pp.29-31 below.
[61] Lehoux (2007).

This summary of how the scholarship on weather signs currently stands has identified a number of trends:

(1) There has been a general tendency to overlook them,[62] especially in favour of the astronomical side of ancient weather prediction.

(2) It has been largely assumed that ancient Greeks and Romans simply trusted the predictions of weather signs and that the practice of applying them is straightforward. As a result, scrutiny of their practicality and usefulness has been a largely ignored. Where it has been discussed, there are scholarly opinions that are, in my view, misleading.

(3) There has long been the assumption that the Roman authors of the late Republic simply transplanted weather signs into their work from Greek texts with no great consideration other than the stylistic.

(4) Most importantly for this thesis, the overwhelming methodology of studies into weather signs has been to look view them solely within the literary tradition of weather signs. Thus the most common task to perform is to simply compare the appearance of certain signs across a range of texts. They have, then, been studied in something of a vacuum, with their relation to other predictive methods or wider discourses being ignored.

The lack of attention that weather signs have received means that scholarly trends such as these are really the result of very small numbers of academic works, the conclusions of which are readily accepted and often go unchallenged due to the lack of anything stating different conclusions. Where, as will happen, I argue for precisely the opposite to earlier scholars, this is usually not a rejection of a long scholarly tradition but the questioning of a single key scholarly work.

This thesis aims to address the above areas in the current scholarship by considering weather signs within a wider scientific, cultural and predictive context. Rather than searching within the immediate weather sign tradition itself, I intend to suggest a number of external factors that were affecting the treatment of weather signs, some of which are mentioned in the opening section of this introduction. I wish now to look in a little more detail at point (4) above, and raise an objection against what has been a very common methodology for reading weather sign lists.

[62] This neglect was noted by Cameron Shelly in his 2000 article on Pre-Socratic meteorology. He stated that "Folk meteorology [of the weather sign sort] has been almost completely neglected even by folklore scholars, so it is not surprising that it has escaped the attention of philosophers and classical scholars as well": Shelly (2000) 2.

4. A Methodological Objection

By far the most dominant scholarly method for the analysis of weather sign lists has been looking for changes in lists, according to the appearance or disappearance of certain signs. This methodology is very common amongst existing scholarship on weather signs and ancient meteorology more generally, and is one reason why this work has been, in my opinion, deficient in assessing the questions I am concerned with here. So, for example, the general pattern that 'sign *x* appears in text *y*, but not text *z*: therefore text *y* cannot be based on text *z*' is followed. Douglas Kidd, in his 1997 commentary on the *Phaenomena*, makes a statement that exemplifies this approach:

> "A comparison of A[ratus]'s signs with those in the *DS* shows that, while the poet does seem to derive the majority of his signs from the material preserved in the *DS*, he also has many that do not appear in the extant work[63]…A[ratus]'s source for his weather signs must therefore have been a fuller work, containing the material of the *DS*, but also much more."[64]

But he is by no means alone in this approach. This method is, I believe, deeply flawed and very rarely helps solve problems associated with confused patterns of transmission.

In particular, it relies too heavily on the (incorrect) assumption that weather sign lists are constructed from a fixed body of signs, all of which belong to a textual tradition. The ancient evidence just simply does not have it this way. Both the *De Signis* and *Phaenomena*, after all, explicitly allow for the invention and inclusion of new signs:

> *De Signis* 1:
>
> Σημεῖα ὑδάτων καὶ πνευμάτων καὶ χειμώνων καὶ εὐδῖων ὧδε ἐγράψαμεν καθ' ὅσον ἦν ἐφικτόν, **ἃ μὲν αὐτοι προσκοπήσαντες**, ἃ δὲ παρ' ἑτέρων οὐκ ἀδοκίμων λαβόντες.
>
> "We wrote down the signs of rain, winds, storms, and fair weather as follows to the extent that we were able, **some of which we ourselves observed**, others of which we took from not unknowledgable men."

[63] The *Diosemeiai* contains around twenty signs that are not included in the *De Signis*. These are, with line numbers: 796 a third days moon's reddish disc; 802 a third day sign valid for the whole month; 812 and 815-7 multiple haloes; 822-3 dark marks on the sun's disc; 838-9 black and red marks on the sun; 841-4 sun's rays concentrated or overarched with clouds; 845-7 light cloud rising before sunrise; 847-9 a thick belt of cloud before sunrise; 851-3 clouds at sunset after rain during the day; 859-60 rays dark of slightly dark; 905-8 one Ass faint, the other bright; 941 star halo; 1060-1 squill flowering; 1118-21 snow on cornfields; 1104-12 sheep jumping around or dawdling; 1118-21 cows lowing continuously; 1122 goats eating evergreen oak leaves; 1123 sows tossing straw; 1137 mice; 1138 a crab on shore; 1140-1 mice tossing straw. List after Kidd (1997) 22-3.

[64] Kidd (1997) 22-3.

Phaenomena 776-7:

τὰ δέ που καὶ ἀπ' **ἄλλων ἔσσεται ἄλλα**
σήματα καὶ περὶ νυκτὶ καὶ ἤματι **ποιήσασθαι.**

"Indeed, there will be other signs for you to **make your own from other sources** concerning night and day."

With the admission from the author of the *De Signis* that some of the signs were observed by the compilers and Aratus' statement that there are other signs still to be devised, there is evidently an acceptance that weather signs lists do not constitute a fixed body of knowledge. New weather signs were being added to the body of knowledge as a whole, and, presumably, existing signs were developing and changing.[65] The *De Signis* passage above embodies this beautifully, demonstrating that existing signs "taken from men of no small repute" could be mixed with new signs, ones which "we ourselves have observed". Similarly, not including a weather sign in a list would not necessarily preclude the existence of that weather sign elsewhere; if not operating through textual channels, it could be preserved in the non-textual ones, recorded in 'oral memory', and could thus re-enter a textual tradition, not necessarily in exactly the same form in which it left it, at any time. Further to this, as I will demonstrate below, weather signs did not have to develop from a scientific grounding, or go through a vetting process; thus anyone and everyone could make one up and they do not have to be based in any way on what has come before them.

5. 'Practicality' and 'Reality'

The way in which this thesis will most frequently discuss the two predictive methods is in terms of how their 'practicality' or 'utility' is described and presented. As this thesis will show, it is by asking questions about the extent to which the ancient Greeks and

[65] For weather signs becoming gradually more specific over time, rather than those deemed to be wrong simply being dropped, see Bergen and Newell (1889). I would not wish to give the impression, however, that the lists were changing radically: the same signs that appear in the fourth century BC appear continuously into much later texts. A good example of this is a cow looking to the sky and sniffing indicating rain. This can be found in the *De Signis*, in Aratus' *Phaenomena*, it features as part of Cicero's translation of Aratus in the *De Divinatione*, in a fragment of Varro Atacinus, in Vergil's *Georgics*, in Pliny's *Natural History*, in Aelian's *On Animals*, in the form of an Aratean quote in the Byzantine farming handbook the *Geoponica*, in 16th century weather handbooks (see Digges' *A Prognostication of Right Good Effect* 1555), quoted by Inwards (1864) 180 – "If bestes eate gredyly, if they lycke their hooues, if they sodaynly moue here and there making a noyse, **brethyng up to the ayer with open nostrels**, rayne folowyth"), and even in modern practical guides to weather lore like Page (1977) 14. In this final entry, we see the increasing specificity described by Bergan and Newell. The sign has now become "if they [cows] are seen sniffing the air, and then walking down hill towards the farmyard, then rain or storm will follow".

Romans viewed astrometeorology and weather signs as methods that could be applied to making reliable weather predictions that revealing answers are given about how the two methods are connected, and the differences between the two methods are most clearly articulated. We must remember, after all, that weather prediction was not a purely theoretical exercise in antiquity; it was routinely taking place. It is therefore not surprising that questions about the active application of the methods are often close at hand in our sources.

We must be careful, however, not to conflate these literary discussions and accompanying attitudes with the realities of prediction too readily. Although a text may discuss something in a practical context or in way that is useable, it does not necessarily mean it was actually used in that way. So, for example, I will argue that the *De Signis* is a text that presents, through its opening comments and organisation, weather signs as usable weather predictors. Was the *De Signis* actually ever used by someone in antiquity to predict the weather? We have no possible way of knowing; all we can say is that it deals with weather signs in such a way that their use from it was possible and encouraged, and thus that it appears to approach and present them in a practical manner.

Since both ancient agriculture texts and didactic poetry frequently purport to be instructive in tone, acknowledging this potential for distance between the apparent purpose of a text and its final function has become a common methodological feature of their criticism and study.[66] It is said of Hesiod's *Works and Days*, for example, that his audience could never have actually farmed from it, since its advice is too general and not specific enough,[67] or appears to be anomalous.[68] So too Cato's *On Agriculture*, which purports in its preface to recount instructions for practical farm workers, has been revealed to be both insufficient in its level of detail, and have a focus not on farm work, but on the economics of the farming business.[69] In reading ancient meteorological texts, then, we should not necessarily expect to build up a true picture of 'real life'; material may be deliberately presented in a particular way. It is important to stress, therefore,

[66] Heath (1985) remains, in my opinion, one of the finest treatments of questions of didactic intent, seeing as he does different potential levels and forms of didactic intent. For other examples of this methodology, see Bing (1994), who questions the 'reality' of Aratus' advice; Volk (2002) 3-4, who states that "the vexed question of whether…Vergil really wanted to teach farmers with his *Georgics*…will not find an answer in my work"; Volk (2009) 175-181 on the possibility of distance in relation to Manilius' *Astronomica.* Toohey (1996), however, tends to read didactic poetry with the broad assumption that they are indeed attempting to teach what they say they are. He does however, appear to bring this into question when discussing how 'playful' didactic poets could be – see Toohey (1996) 232-251.
[67] See Heath (1985) 225.
[68] Nelson (1996) 47.
[69] White calls this one of the 'myths' of the *On Agriculture*. See Toynbee (1965) 297-302 and White (1973) 456.

that throughout this thesis, I deal with changing ancient views of astrometeorology and weather signs and how these views are expressed in the written treatment, and not with the actual ancient predictive practices that were employed. Much of this thesis will be able, however, to inform further discussion of this topic, which is currently lacking.[70] When 'utility' and 'practicality' are mentioned, then, I refer to the presentation, and accompanying effects, of those concepts within the texts themselves.

As Taub has rightly noted in her work on ancient meteorology, we must also be conscious that the texts we deal with each served a purpose in the authors' minds quite different from that for which they are now being used; no author would have foreseen their purpose in, two thousand years later, constructing a history of weather signs.[71] Therefore, we must, as best as we are able, attempt to read texts within at least some context of what we can access about the author's motives, both stated and suggested, for its composition, and how this affects the presentation of the material.

Indeed, that this thesis is often required to gain information about weather signs from texts which certainly did not have weather signs as the focus of their attention raises another methodological point. As I have already demonstrated in this introduction, weather signs are phenomena of 'no fixed abode'. We find them as frequently in philosophical treatises as we do in didactic poetry and in technical prose writing. Thus a multi-genre, 'patchwork' approach is necessitated in order to build up as fuller picture as is possible. But the evidence to be discussed here is not limited to the purely literary; we will also call upon a number of inscriptional parapegmata as astromeorological sources. It should not concern us that such different literary types should be given generally equal weighting. Taub has shown that the exchange of information between prose and poetry was fluid, and that prose writers often call on poetic authorities, especially in meteorological discussions.[72] Of course, sometimes a lack of evidence requires us to lean heavily upon a single source, but it is my intention to ensure that my conclusions are based on a range of evidence, poetry, prose, and material, all interpreted alongside one another.

Directly connected with this is the fact that we must be conscious of how much detail we can expect to extract from our sources. For example, are we likely to build up intricate taxonomies of the perceived reliability of specific weather signs? No; the level of detail in the texts is too inconsistent and, often, lacking. Indeed, this is a further

[70] As Hine (2005) 88 has noted.
[71] Taub (2003) 3.
[72] See Taub (2003), especially 16-59, but also 3 for a direct statement of this.

reason on which I object to the source analysis method of studying weather signs I have argued against above. Can we get an indication of whether particular methods of prediction are being viewed as useful predictors? Yes; their presence or absence in a text may indicate this to us. Again, this is where a patchwork approach can yield fruitful results – by making comparisons between sources and building up a level of detail in that way, which would certainly be questionable if assumed from a single source.

Although I have stated that this thesis is not concerned with actual ancient predictive practices, becuase it deals with the treatment of weather signs by literate (and specifically astronomically literate), and thus probably largely elite Greeks and Romans, it may be reasonably asked whether these kind of people were engaged in weather prediction, and thus if they would have really been concerned about questions of practicality. In the final section of this introduction, I will briefly consider this issue, and argue that we should be broadening our scope when thinking about the users and predictors of the weather in antiquity really were.

6. Who Predicts?

Many studies of ancient meteorology and weather prediction have made the un-questioned assumption that in the ancient world, those who wanted to predict the weather did so for one of two reasons: either they were sailors, or they were farmers.[73] This is for the simple fact that almost all the depictions we have of weather prediction in ancient texts are of these two groups of people, and the contexts in which prediction is discussed are mostly nautical and agricultural.[74] This assumption has been occasionally problematised over the last 25 years, the main difficulty being one of literacy.

A number of scholars have noted that our knowledge of weather prediction comes via written sources, be they lists of weather signs or inscriptional and literary parapegmata, but literacy levels in antiquity, especially amongst rural populations, is thought to have been very low indeed.[75] Harald Reiche in his 1989 article, for example, stated that "when Meton finally inserts stellar phases into the radically improved lunisolar cycle that bears his name, the calendric needs of farmers at last came into their

[73] See, for example, McCartney (1926a), who writes about the weather prediction of the "rustics and seamen" of antiquity; Cronin (1992) 308 states that the *De Signis* is a text for the "general reader, especially farmers and sailors".
[74] The beginning and subsequent influence of these depictions in antiquity are discussed in this thesis, *passim*.
[75] On which, see Harris (1989) 67-8: "There is…not the slightest reason to suppose that the ordinary Greek farmer made use of writing."

own, albeit in a form inaccessible to all but a literary minority."[76] Robert Hannah too notes that "…the inscription [a parapegma] was meant to be seen by the public. Admittedly, it does not mean that everyone was expected or able to read it."[77] No attempt is made by Reiche to rectify this disparity. Hannah, however, suggests an argument frequently made of ancient inscriptions, that a parapegma "at the very least could have served the purpose of monumentalizing an idea that the state wished to be made public. Even if only a few could read it and then understand it, nevertheless the intention would seem to have been that the parapegma should have at least a visual impact on more than just an elite, literate few".[78] But for those elite, literate few, it must have been performing some specific function; monumentalization cannot have been the full story, or why would anyone have bothered to move the peg along the holes? Hannah thus suggests that parapegmata were erected to keep religious festivals in time with the agricultural seasons.[79] As Lehoux has pointed out, though, festivals are exceptionally rare on Greek parapegmata, with only two known to include them.[80] In addition, how do we account for the weather prediction elements on astrometeorological inscriptional parapegmata, like Miletus II?[81] This too, then, cannot be a full account of the functions of a parapegma.

If we buy these theories, we are left with written methods of weather prediction, with an illiterate supposed audience. This situation is clearly untenable and needs serious revision. What I propose is something that the scholarship has apparently been oddly cautious to suggest: that the presence of written works on, and public inscriptions describing, weather prediction suggests that literate people were predicting the weather. The only scholar to have hinted towards this idea has been Liba Taub, who has gathered evidence for the fact that in two locations from which inscriptional parapegmata are known to have come from, Miletus and Puteoli, there was a social emphasis on education, and education was known to have systematically taken place, meaning that the parapegmata were most likely legible to at least some of the population.[82] Parapegmata, then, would have been performing not only a monumentlizing function, but also a practical weather predicting one. Taub is quite right, I think, to view weather prediction as also part of the life of the literate in the ancient world, but I would

[76] Reiche (1989) 43.
[77] Hannah (2001) 155.
[78] Hannah (2001) 155.
[79] Hannah (2001) 156.
[80] Lehoux (2007) 153-4.
[81] For details of which, see Lehoux (2007) 154-7, with images and references.
[82] Taub (2003) 42.

certainly go further and suggest that it was also being performed by an educational and societal elite in these places and in others, including urban centres. We have, after all, plenty of evidence for both literate Greeks and Romans, and even the elite, being interested in, writing about, and theorising on, weather prediction – much of it will, of course, be presented in this thesis. The Julian Calendar reform, to select just one such example, will be seen as something that although very much driven by the elite of Rome, represents a very real acknowledgement of the influence and usefulness of weather prediction.[83]

Sider and Brunschön have carried out a short survey of the stated main audiences of literature on weather signs. From a range of texts and dates, they have identified farmers, sailors, millers, herdsmen of various sorts, military planners, fishermen, merchants and (not explicitly stated, but implied) physicians.[84] Predominantly, then, rural occupations - but certainly not exclusively. The merchants, for instance, who, according to Pliny priced their clothes based on the forthcoming weather,[85] indicate that weather prediction was taking place in urban environments as well as the rural. So to do the inscriptional parapegmata from Puteoli and Miletus, set up as they are in urban environments. The Horologium Augusti, I will argue, further demonstrates this urban interest in the weather and its prediction. Even texts that would seem at first to point clearly to rural ways of prediction, such as Columella's *De Re Rustica*, are, in fact, frequently elite ideas of agricultural practice that have been applied back on to an imagined rural world. There are other instances of the weather appearing in urban centres also.[86] There is, I therefore believe, strong evidence for the fact that weather prediction was far more wide-spread in antiquity than it has been given credit for; it was not only practiced by the farmers and sailors.

[83] See below, pp.161-172.
[84] Although see Sider & Brunschön (2007) 1 n.2.
[85] See Pliny *NH* 18.225.
[86] Wind roses are discussed at Vitruvius' *De Architectura* 1.6.12. Also, wind roses dating from the 2nd and 3rd centuries AD have been found in the centre of, and just outside, Rome. See Taub (2003) 107; 149. For more on ancient wind roses, see p.170 n.181 below and Obrist (1997), especially 41-5.

Part 1: The Greek Weather Sign

This chapter explores the history, function, and treatment of weather signs in a series of Greek texts, covering the Archaic period through to the late Hellenistic. It aims to begin to describe the earliest relationship between astrometeorology and weather signs and argue that developments in astronomy profoundly affected the early written weather sign tradition. The chapter will begin by outlining the origins of the terrestrial weather sign, and how the function of natural signs as indicators has changed over time. It then approaches the question of whether the weather signs featured in the Greek texts covered here are presented in a practical manner and outlines a new model for their use, arguing that knowledge of series of astronomical observations and principles underlies their operation. This allows a picture to be developed of how the two predictive methods were thought to relate to one another, the details and explanation of which form the third section of this chapter. The final section is devoted to investigating how weather prediction is depicted in Greek texts, and what this can tell us about the relationship between the methods.

Before doing this, I wish to very briefly set up some intellectual context to the texts in this chapter. The astronomy of seventh century Greece, such as was practised by Hesiod, has been characterised by James Evans as simple, "popular-practical" astronomy,[1] originating far back beyond the beginnings of writing, and having gained particular traction in Babylonia, where systematic observations of celestial and meteorological phenomena are known to have taken place.[2] The Greek 'scientific' traditions in these disciplines, along with many others, may well have their roots in the 6th century philosophy of the Ionian 'Presocratics', who are certainly presented by later sources as having been interested in meteorological theories.[3] We have, however, no evidence for whether they undertook study into weather signs. In the fifth century, ancient scientists such as Euctemon and Meton appear to have worked extensively on refining and expanding stellar time-reckoning, [4] though the extent of their interaction with Babylonian sources is unknown.[5] It is clear from the statements attributed to

[1] Evans (1998) 17.
[2] Evans (1998) 5-17; see also Lloyd (1979) 169-99 and Lehoux (2007) 12.
[3] See Frisinger (1971) and Taub (2003) 72-6.
[4] See Evans (1998) 20, who argues that the aim of this work was to unify Greek civil calendars. See also Dicks (1970) 87-8 on Meton and Euctemon and Lloyd (1979) 172-3. On Classical astronomical time-reckoning more generally, see Wenskus (1990); West (1978) 376-81; Nilsson (1920) 110-113.
[5] See Evans (1998) 20 and Lehoux (2007) 98-115, especially 99. Lehoux concludes (115) that there is no clear evidence to connect Mesopotamian astronomy with the parapegmata tradition.

Euctemon[6] that his observations were considerably more sophisticated than Hesiod's and gave a fuller picture of celestial movement by incorporating a greater number of risings and settings.

It is primarily through interaction with these earlier thinkers that Aristotle built up and taught his theories in the Lyceum[7] and it is in that school that the *De Signis* was written. As we shall see, however, it differs from the Lyceum's typical or 'expected' output in a number of significant ways. Aratus' *Phaenomena* is a product of the scholarly court-society that flourished throughout the Hellenic world in the third century BC and, apparently being based on an astronomical treatise by the fourth century astronomer Eudoxus, reflects the contemporary interest in the versification of technical topics.[8]

1. The Changing Agricultural Sign

The Role(s) of Natural Signs

Prognostic weather signs of the type discussed above in the introduction to this thesis were originally presented as considerably more than just indicators of forthcoming weather. Our earliest classical sources suggest that like astrometeorology,[9] as well as being connected to the weather, they began life bound up with time-reckoning and specific activities. We see this most clearly in a sign taken from Hesiod's *Works and Days*:

> φράζεσθαι δ', εὖτ' ἂν γεράνου φωνὴν ἐπακούσῃς
> ὑψόθεν ἐκ νεφέων ἐνιαύσια κεκληγυίης:
> ἥτ' ἀρότοιό τε σῆμα φέρει καὶ χείματος ὥρην
> δεικνύει ὀμβρηροῦ· κραδίην δ' ἔδακ' ἀνδρὸς ἀβούτεω·
>
> "Take notice, when you hear the voice of the crane every year calling from above out of the clouds; she brings the sign for ploughing and indicates the season of winter rain. This bites at the heart of the man without oxen."
> - *Op.*448-451

In this passage, hearing the voice of a crane does much more than simply warn us of coming rain. It indicates the right time to start our ploughing and serves as a chronological marker, denoting the beginning of the winter season. We see, then, that the

[6] See Hannah (2002) 145-7 for examples from various sources.
[7] On the role of the study of nature in the Lyceum's 'curriculum', see French (1994) 22-40.
[8] The standard comparison here is that of the didactic poetry of Nicander, which treats the topics of venomous animals and their antidotes.
[9] On which see Lehoux (2007) 5-9; 30-5

time of year, the weather, and what must be done are intrinsically and perfectly logically, due to seasonal changes, linked together in these early signs.

The signs do not, however, always provide all that information. The following sign, for example, just gives agricultural advice:

> ἀλλ᾽ ὁπότ᾽ ἂν φερέοικος ἀπὸ χθονὸς ἅμ φυτὰ βαίνῃ
> Πληιάδας φεύγων, τότε δὴ σκάφος οὐκέτι οἰνέων·
>
> "But when the house-carrier climbs up from the ground, fleeing the Pleiades, there is no longer any digging for vines."
> - *Op*.571-2

Despite the absence of a meteorological or time-reckoning element in this sign, I think we can still view it as being approached with the same mind-set as the crane sign discussed above; they form part of an agricultural system of knowledge[10] in which the end aim is really to know what tasks must be done when,[11] for which signs are needed. Sometimes these tasks are wholly dependent on the weather, and therefore sometimes the time of year, whereas other tasks should simply be done at certain points in time, probably because they yield the best results when completed then. The natural phenomena that carry significance in the *Works and Days* are not divided into groups according to, for instance, 'weather signs' or 'time-reckoning signs'; they fulfil any number of roles within a wider body of knowledge. The weather, therefore, is just part of this knowledge.

We can see further evidence of the general unity of early literary agricultural knowledge in the fact that there is no one type of sign for obtaining this kind of useful information. Elsewhere, Hesiod tells us how we can make the same type of predictions using astronomical indicators:

> ἥματα πεντήκοντα μετὰ τροπὰς ἠελίοιο,
> ἐς τέλος ἐλθόντος θέρεος καματώδεος ὥρης,
> ὡραῖος πέλεται θνητοῖς πλόος...
> τῆμος δ᾽ εὐκρινέες τ᾽ αὖραι καὶ πόντος ἀπήμων·
>
> "For fifty days after the solstice, when the summer comes to an end, the toilsome season, sailing is in good season for mortals …
> That is when breezes are easy to distinguish and the sea is painless."
> - *Op*.663-5; 670

[10] For studies of the agriculture of the *Works and Days* see see Nelson (1996) and Edwards (2004) 127-158.
[11] To see the agricultural content as honestly and solely agricultural in intent is, of course, to ignore to complexity of the text as a whole. As has often been noted, agriculture and work are closely intertwined with justice and morality in the *Works and Days*: see Strauss Clay (2009) for a recent restatement of this. Similarly, Tsagalis (2009)147-150 sees Hesiod's agriculture as an analogy for the poetic process. Straus Clay (2009) 77 also notes that agriculture may be one of the things that connects Hesiod to a "pre-existing genre of advice poetry".

Here again, we see the same intertwining of time-reckoning ('end of the season of weary heat'), the weather ('then the winds are orderly') and activity ('the time for mortals to sail').

In Hesiod's poem, a fixed astronomical event, it would seem, is just as valid a sign as, for example, the behaviour of a bird. There appears to be no differentiation in the *Works and Days* between the types of sign used; sometimes the weather and time is determined from animals, sometimes from the stars. West is therefore quite right to characterise this as a "rudimentary 'natural' calendar… based on observation of the solstices (and to a lesser extent of the equinoxes, which were less easily determined), the risings and settings of a few prominent stars and star-groups (Pleiades, Hyades, Orion, Sirius, Arcturus), the condition of certain flora, and the behaviour of certain fauna".[12]

Because these signs were so linked to activies, it seems most likely that this body of agricultural knowledge would have originally developed according to two factors; location and occupation. It is clear from evidence later in the weather sign tradition that regionally-specific and occupationally-specific signs were common. So, for example, Aratus tells us that shepherds have signs taken from the behaviour of sheep:

> ἀρνάσι μὲν χειμῶνας ἐτεκμήραντο νομῆες,
> ἐς νομὸν ὁππότε μᾶλλον ἐπειγόμενοι τροχόωσιν,
> ἄλλοι δ' ἐξ ἀγέλης κριοί, ἄλλοι δὲ καὶ ἀμνοὶ
> εἰνόδιοι παίζωσιν ἐρειδόμενοι κεράεσσιν·
> ἢ ὁπότ' ἄλλοθεν ἄλλοι ἀναπλίσσωσι πόδεσσι
> τέτρασιν οἱ κοῦφοι, κεραοί γε μὲν ἀμφοτέροισιν·
> ἢ καὶ ὅτ' ἐξ ἀγέλης ἀεκούσια κινήσωσιν
> δείελον εἰσελάοντες ὅμως, τὰ δὲ πάντοθι ποίης
> δάκνωσιν πυκινῆισι κελευόμενα λιθάκεσσιν.
>
> "Shepherds foretell storms from sheep whenever they run to pasture more hastily than usual, and some of the flock, rams, and lambs, gambol on the way, butting each other with their horns; or when here and there they kick up their feet, the nimble ones with four, the horned with two; or when the men move them from the flock, driving them home in the late afternoon despite their reluctance, and they keep nibbling the grass all the way, though pushed on by masses of stones."
>
> - *Phae*.1104-1112

And the *De Signis* features signs taken from specific locations, such as the significance of Mt. Hymettos:

[12] West (1978) 377. This kind of time-keeping by a 'natural calendar' is nicely demonstrated on the so-called 'Swallow Vase', a 6th century BC pelike depicting three men identifying a flying swallow as a sign of spring. For discussion, and good illustrations, of this vase, see Immerwahr (2010).

Ὕμηττος ὁ ἐλάττων, ἄνυδρος καλούμενος, ἐὰν ἐν τῷ κοίλῳ νεφέλιον ἔχῃ, ὕδατος σημεῖον.

"If the Lesser Mt. Hymettos, called the 'Dry', has a small cloud in its valley, this signifies rain."

- *DS.*20

It has long been held that such signs first developed through simple observational experience[13] (in which patterns between phenomena and the weather were noticed and remembered, either for application, or for further testing when the phenomena was seen again), and I see no reason to question this. It is thus most likely that the use of terrestrial signs here is being portrayed in a similar way to how we imagine the stars would have been observed - Lehoux rightly argues that Hesiod's advice appears to be "to remember a few rules of thumb and to call them to mind when one knows…that a phase is occurring".[14] So on Hesiod's poetic farm, the terrestrial signs would be applied in a similar way; one would either keep an eye or ear out for a few indicating signs at around the right time of year and hopefully spot them, or have a fortuitous sighting of a sign. The vast majority of the signs, after all, are unpredictable with regards the timing of their appearance, a feature on which I have already commented,[15] and will be discussed in more detail later.

Sider and Brunschön[16] are very keen to dislocate Hesiod from any later weather sign tradition, arguing that Hesiod's signs are 'calendrical' whereas signs in later texts, such as the *De Signis*, are temporally 'imminent' and therefore represent a separate tradition. By making this distinction, they not only theorise a division between types of signs based on texts potentially as much as four hundred years apart, but also prohibit themselves from exploring any potential development between Hesiod's time and when the *De Signis* was written. We are actually quite right, I believe, to look at Hesiod's signs as the precursors to the signs of the type contained in the *De Signis* and subsequent later texts. As I have argued above,[17] temporality of significance does not appear to play a substantial part in the fundamental division of ancient weather prediction and we therefore cannot use this as a distinguishing characteristic. Both the Hesiodic and *De Signis* signs have at their core the same fundamental principle; that useful information can be obtained through the observation of natural phenomena.

[13] See, for example, Hazen (1900) 191: "Weather folk-lore is based on the knowledge of the common people acquired through the ordinary observation of nature, animals, plants, etc. unaided by instruments."
[14] Lehoux (2007) 65.
[15] See p.11 above.
[16] Sider and Brunschön (2007) 2-3 and 6.
[17] See pp.5-11.

At the time of the writing of the *De Signis,* these agricultural signs appear to have become quite radically different. Let us take a sample paragraph:

> καὶ ἐὰν ἐκ πελάγους ὄρνιθες φεύγωσι χειμῶνα σημαίνουσι. καὶ σπίνος ἐν οἰκίᾳ οἰκουμένῃ φθεγγόμενος χειμέριον… κόραξ φωνὰς πολλὰς μεταβάλλων χειμῶνος χειμέριον.
>
> "And if birds flee from the sea they signal storm. And a chaffinch singing in an inhabited house is a sign of storm…A raven in winter producing many sounds indicates a storm."
>
> - *DS.*40

The presented function of these signs is now overwhelmingly meteorological; they are there to provide only weather predictions. Gone is their connection to time and therefore activity. Of all the signs in the *De Signis,* only one appears to have a retained this function as any kind of chronological indicator, with mating cows signifying an early winter, perhaps revealing the wider role they once played within agricultural knowledge:

> πρόβατα ἐὰν πρωῒ ὀχεύηται πρώϊον χειμῶνα σημαίνουσι.
>
> "If the smaller cattle mate early they signal an early winter".
>
> - *DS.*40

In addition to these changes to the individual signs, there is evidence of a wider change to be found in the *De Signis*. As discussed above, there appears to be a formalised distinction now made between those predictions made from astronomical signs and those made from terrestrial phenomena. We must therefore ask an important question here; how can we account for the substantial changes that have taken place over the four hundred years between Hesiod and the *De Signis*? This question will form an important recurring theme throughout the rest of this chapter. First, though, it is important to discuss the extent to which the *De Signis* presents itself as a practical treatment of weather signs; does it approach and present weather signs in such a way that suggests they are being deemed a realistic option for systematic prediction?

The Practicality of the De Signis

Sider and Brunschön take a strong view on the practicality of this text, believing much about the *De Signis* "bespeaks a certain impracticality".[18] They object to viewing it

[18] Sider & Brunschön (2007) 37.

as a practical for two key reasons (1) absence of a statement of practical use (2) the arrangement of the signs –grouping by weather type.[19]

To address their first point – they are right that the *De Signis* does not contain an explicit statement of practical use. But it is a text that appears to have practicality at its heart. In the prologue, we find statements such as "anyone who wishes to predict the weather, must pay close attention…" (*DS.* 6) and καθ' ἕκαστα δὲ τῶν σημείων κατὰ τὸν ὑπογεγραμμένον τρόπον, "for each sign one must observe as follows" (*DS.* 9). We are also told διὸ δεῖ προσέχειν οὗ ἄν τις ἱδρυμένος ᾖ. ἔστι γὰρ αἰεί τινα λαβεῖν τοιοῦτον γνώμονα καὶ ἔστι σαφέστατα τὰ σημεῖα τὰ ἀπὸ τούτων, "it is necessary to pay attention to where a person is situated, for it is always possible to find someone to serve as an expert, and the signs from these people are the most accurate" (*DS.* 3). Statements such as these suggest, at least to me, that this text is written for "anyone who wishes to predict the weather" – they tell us how to get the most out of our weather signs, and what we have to understand in order to use them. The prologue certainly does not present the information in the *De Signis* as useless.

Regarding their second point, which will be argued against in detail throughout this chapter, it is for now necessary to note that Sider and Brunschön imagine how someone might make use of weather signs and the *De Signis* and how this relates to its structure. They suggest that "if wolves appear in inhabited areas (where, that is, they are not expected), one should be able to look up λύκοι and discover that a storm is indicated. This same sign occurs in 46, but since in the scene we are painting one does not know what the wolf means, one therefore does not know that the entry for wolf in this work occurs between those on bees and wasps toward the end of the chapter on storm signs."[20] This statement is certainly true for someone who approaches the *De Signis* as Sider and Brunschön imagine, taking a random sign and referencing it against the text, but this is a highly misleading premise to use when thinking about the way in which the weather signs of the *De Signis* are organised. How, after all, would one know what to keep an eye out for? Does one observe every movement and activity of every animal, bird, cloud, plant and insect in the hope that it might just be an indicator of a change in the weather? This truly is impractical, but their entire conception of what makes a list of weather signs 'practical' or 'impractical' is based on the application of this sole theoretical method.[21] Sider suggests a slightly different solution to the problem of how weather signs were used

[19] Sider & Brunschön (2007) 36-7.
[20] Sider & Brunschön (2007) 37
[21] It will be demonstrated throughout this thesis how this leads Sider and Brunschön's conclusions regarding a whole range of texts.

in his 2002 article, in which he wrote that "if a farmer were interested in knowing whether rain was likely he could be imagined thumbing through this work to remind himself of what to look for this day."[22] What is crucially important about Sider's statement here is the idea of not working from sign to text, but from text to sign. This direction of movement is, I will argue, fundamental to understanding ancient weather signs.

Having established that it is indeed possible to approach the *De Signis* as a text that couches weather signs in practical terms, let us return to considering the key change in function in the literate tradition; the loss of a time-reckoning role. I will here argue that the time-reckoning function performed by natural signs in Hesiod's poem is later presented as a purely astronomical system. That astronomical time-reckoning was developed and widely used after Hesiod's time is, of course, well known – but its full significance, or indeed the significance of time-reckoning generally, to understanding weather signs has never been articulated.

Time-reckoning in Weather Sign Lists

For a number of the weather signs contained in the *De Signis*, it is clear that they rely on the operation of another system; a calendar of some description. The significance of the signs in question here is dependent on the time of year at which they are observed. So, for example, thunder changes its meaning according to when in the year it is heard:

> αἱ δὲ βρονταὶ αἱ μὲν χειμεριναὶ καὶ ἑωθιναὶ μᾶλλον ὕδωρ σημαίνουσιν· αἱ δὲ θεριναὶ μαὶ μεσημβριναὶ οὔ. ἑσπεριναὶ δὲ βρονταὶ ὕδατικον σημεῖον.
>
> "Thunder in winter at dawn is a rather good sign of rain. Thunder in summer at midday is not a sign of rain, but thunder in the evening is."
>
> - *DS.*21

The key divisions of time made in the *De Signis* are, as demonstrated in the above example, seasonal (χειμεριναί and θεριναί). The seasonal stipulations are a significant and inherent part of these signs and point to the fact that to use weather signs, one often needs more information than just knowledge of the significance of the sign itself.

Knowing where we are in the time-frame of a year is a very easy thing to do in the modern world. We have standardised time-reckoning devices and concepts that allow us to access this kind of information very quickly. This has not always been the case, however, and we must therefore explore how the seasonal divisions described in the *De*

[22] Sider (2002) 104.

Signis would have been observed. In his introduction, the author of the *De Signis* does sketch out a basic time-reckoning system, based on a mixture of stellar, lunar and solar patterns. Firstly, the rising and setting of the Pleiades divides the year in two:[23]

> διχοτομεῖ δὲ τὸν μὲν ἐνιαυτὸν Πλειάς τε δυομένη καὶ ἀνατέλλουσα· ἀπὸ γὰρ δύσεως μέχρι ἀνατολῆς τὸ ἥμισυ τοῦ ἐνιαυτοῦ ἐστιν. ὥστε δίχα τέμνεται ὁ πᾶς χρόνος.
>
> "The rising and setting of the Pleiades divides the year in two, for there is half a year from setting until rising, and so the entire time is cut in two."
>
> - *DS.*6

Secondly, months are divided up according to the phases of the moon:

> ὡς δ' αὕτως ἔχει καὶ περὶ τὸν μῆνα ἕκαστον· διχοτομοῦσι γὰρ αἵ τε πανσέληνοι καὶ αἱ ὀγδόαι καὶ αἱ τετράδες, ὥστε ἀπὸ νουμηνίας ὡς ἀπ' ἀρχῆς δεῖ σκοπεῖν.
>
> "Likewise with each month: full moons, eighth days, and fourth days serve to divide the month into halves; and so one can view the new moon as the beginning."
>
> - *DS.*8

And finally, the passing of individual days occurs according to the progress of the sun:

> ὡς δ' αὕτως καὶ ἐπὶ τῆς ἡμέρας ἔχουσιν αἱ μεταβολαὶ ὡς ἐπὶ τὸ πολύ. ἀνατολὴ γὰρ καὶ πρωὶ καὶ μεσημβρία καὶ δείλη καὶ δύσις…
>
> "Even during the day changes occur mostly in like manner: for there is sunrise, morning, midday, dusk and sunset…"
>
> - *DS.*9

There is a substantial void, however, between the information provided here and that used throughout the text. Although the year in the introduction is divided in two by referring to the Pleiades, the main body of text of the *De Signis* makes reference to a full five-season system of division, in which spring, summer, 'late summer', autumn, and winter are all referred to individually.[24] We are not told in the introduction how this system operates, what defines the chronological parameters of each of the seasons and how this relates to the system outlined in the introduction, as given above. So how would this have been done? As Lehoux has argued, "knowing when the seasons begin and end is clearly very important in a number of ancient disciplines, and…the calendars available to the Greeks and Romans before Julius Caesar were not ideal for reckoning this".[25]

[23] For a diagrammatic representation of this chronological scheme, see Cronin (1992) 324.
[24] ἔαρ, θέρος, ὀπώρα, μετόπωρον, χειμών. See *D.S.*44.
[25] Lehoux (2007) 8.

From what we have seen above, it seems that what is most likely to be employed in the text was, instead, a series of astronomical markers; the *De Signis* author's use of the Pleiades, moon and sun as time-reckoning devices does indeed suggest that this is the most likely option.[26] That other Peripatetic works works also reveal a knowledge of astronomical time-reckoning, and that these are specifically tied to a seasonal structure, has been argued and demonstrated by A.L.Peck (of Aristotle's *History of Animals*)[27] and Benedict Einarson (of Theophrastus' *De Causis Plantarum*).[28]

As a comparison to the *De Signis*, I want to turn now to Aratus' *Phaenomena*. Although these two texts are in many ways very different, not least because the former is prose, the latter poetry, they have many similarities, both in broad structure and minute detail, some of which will be discussed here in this chapter. It is therefore advantageous to read the two texts together. So, what of Aratus' *Phaenomena*? Is the weather sign list of that text also shown to be underpinned by astronomical time-reckoning?

The *Phaenomena* actually presents us with a much fuller picture of time-reckoning than the *De Signis*. A detailed passage of 295 lines, spanning lines 462-757, describes the movement of the stars, how simultaneous risings and settings of specific constellations can be used to estimate time at night, how months pass according to the moon and finally touches on how the passing of the year can be gauged. His weather signs too seem to assume knowledge of this chronological system. So again, we find certain signs are only applicable at certain times of the year, e.g:

> ἢ λύχνοιο μύκητες ἀγείρωνται περὶ μύξαν
> νύκτα κατὰ νοτίην, μηδ' ἢν **ὑπὸ χείματος ὥρην**
> λύχνων ἄλλοτε μέν τε φάος κατὰ κόσμον ὀρώρηι,
> ἄλλοτε δ' ἀίσσωσιν ἄπο φλόγες ἠύτε κοῦφαι
> πομφόλυγες...
>
> "[Let none of these warnings be neglected if you are on your guard against rain]…not if snuff collects round the wick of a lamp on a humid night, nor if **during the winter season** sometimes the flame of a lamp rises steadily, and sometimes sparks fly off it like airy bubbles…"
>
> - *Phae*. 976-80

Exactly how one divides the year into seasons is not described in the text. Instead, it is simply stated that the information is already available and therefore, does not need recounting here:

[26] Cronin (1992) 318-9 has outlined a potential astronomical scheme for the seasons of the *D.S.*
[27] Peck (1970) Appendix A, pp.383-408.
[28] Einarson & Link (1976) xlvi-lix.

...τὰ δέ που μέγαν εἰς ἐνιαυτόν,
ὥρη μέν τ' ἀρόσαι νειούς, ὥρη δὲ φυτεῦσαι,
ἐκ Διὸς ἤδη πάντα πεφασμένα πάντοθι κεῖται.

"…But as for the times of the great year, the time to plough fallow land, the time to plant trees, from Zeus these are all already available."
- *Phae.* 741-3

It is important to note here that Aratus reveals knowledge of the Metonic cycle, designed (supposedly by Meton in 432BC) to correlate the solar year and the lunar month, [29] and thus provide a time-reckoning system that successfully incorporated both elements:

...τὰ γὰρ συναείδεται ἤδη
ἐννεακαίδεκα κύκλα φαεινοῦ ἠελίοιο;

"…for already the nineteen cycles of the shining sun are celebrated together."
- *Phae.*752-3

That this is referred to in the *Phaenomena*, in addition to time-reckoning concerns of lines 462-757, suggests that any time-reckoning required by the text is fulfilled through a method that employed the heavens. Seasonal divisions in place in the text are thus likely to be astronomical also.

Underlying the prognostic weather signs of the *De Signis* and *Phaenomena*, then, there appears to be a knowledge of stellar phases and their use as chronological reference points. The use of these as the time-reckoning method may very well, I suggest, account for the loss of this function by signs themselves in our texts. As astronomical understanding developed in sophistication and completeness, it became the dominant method of time-reckoning and thus any such function that the weather signs held was replaced. This change is exemplified in a sign common to the *Works and Days* and *Phaenomena*; that of the crane signifying the start of winter, also discussed above. I quote both examples here:

Hesiod: *Op.*448-451
φράζεσθαι δ', εὖτ' ἂν γεράνου φωνὴν ἐπακούσῃς
ὑψόθεν ἐκ νεφέων ἐνιαύσια κεκληγυίης:
ἥτ' ἀρότοιό τε σῆμα φέρει καὶ χείματος ὥρην
δεικνύει ὀμβρηροῦ· κραδίην δ' ἔδακ' ἀνδρὸς ἀβούτεω·

[29] 19 Solar years is equal to 235 lunar months. Each month was given an average of 30 days, totalling 7050 – 110 more than the actual length of 235 lunar months. 110 of the months had to therefore to designated twenty nine days long, 125 months of thirty days. This totals the correct 6940 days. To ensure even distribution across the cycle, a day had to be removed once every 63 days (6940/100 = 63). For more on this, see Geminus, *Isagoge* 8.50-8 with Toomer (1974) 337-40, Lloyd (1979) 171-2, Kidd (1997) 435-6, Hannah (2005) 55-8.

> "Take notice, when you hear the voice of the crane every year calling from above out of the clouds; she brings the sign for ploughing and indicates the season of winter rain. This bites at the heart of the man without oxen."

> Aratus: *Phae*. 1077-81
> αὔτως γὰρ χειμῶνες ἐπέρχονται γεράνοισι,
> πρώια μὲν καὶ μᾶλλον ὁμιλαδὸν ἐρχομένησιν
> πρώιοι· αὐτὰρ ὅτ' ὀψὲ καὶ οὐκ ἀγεληδὰ φανεῖσαι
> πλειότερον φορέονται ἐπὶ χρόνον, οὐδ' ἅμα πολλαί,
> ἀμβολίῃ χειμῶνος ὀφέλλεται ὕστερα ἔργα.

> "For the coming of winters corresponds to that of the cranes, early when they come early and in large flocks; but when they appear late and not in flocks, and take a longer time, not in large numbers, the delay of winter benefits the work done late."

The descriptions of the crane here represent, I think, a shift in how 'absolute' terrestrial signs are depicted as chronological markers. In Hesiod's sign, there is little doubt that the crane is the marker of the arrival of winter; it 'brings a sign' (σῆμα φέρει) and explicitly denotes (δεικνύει). It really is the sign to use if one wants this information; it is the absolute indicator, unrelated to other signs or factors. The arrival of Aratus' crane at the start of winter is substantially different. The crane is no longer a stand-alone, absolute sign. Instead, what it seems to denote is irregular winters, the time of its appearance now taken in relation to some other factor. So it is that, we find language that is not absolute, but relative; 'early' (πρώια… πρώιοι), late (ὀψέ) and delayed (ὕστερα). But earlier than what? Later than what? 'Than usual', perhaps, but also maybe 'than the astronomical indictor of that season', a common way, as I shall demonstrate later, of referencing weather signs against the fixed, expected, appearances of stars. This loss of time-reckoning function to an astronomical method I have suggested here is entirely concordant with what is known about the early development of astronomy in the period between the composition of the *Works and Days* and the *De Signis*, which, as outlined above, was particularly interested in time-reckoning.

Like their Hesiodic predecessors, the observations of the fifth century scientists like Euctemon had more than just a time-reckoning function;[30] they often had a connection to the weather. The result of this period of the development in the complexity of the relationship between astronomy, time-reckoning and weather prediction has been summarised by Lehoux:

[30] It is not entirely clear whether Euctemon himself composed a parapegma as we would recognise it, or simply a series of detailed stellar observations. On this, see Hannah (2002) and (sceptical of the idea that Euctemon composed a parapegma) Lehoux (2007) 21.

> "…by the third century BC, and possibly even earlier, these rules of thumb [the basic stellar observations linked to weather seen, for instance, in Hesiod] had been developed by the Greeks into a more complex system of weather prediction that accounted for more than just the beginnings and ends of seasons and a handful of weather rules. What we see is the emergence of a detailed set of correlations that tie specific weather phenomena to a host of stellar phases throughout the year. In order to keep track of the increasing number of significant phases, something more than just the farmer's memory was needed, and this gap was filled by an instrument – using this word in a very broad sense – called a *parapegma*."[31]

Since the authors in our texts are making use of stellar time-reckoning and, as can be seen by the inclusion of the Metonic cycle, evidently aware of developments in astronomy, we must now consider where the development of astrometeorology fits into their texts, and from that, the relationship between astrometeorology and weather signs they create. I will here argue that to fully understand the weather signs of the *De Signis* and *Phaenomena*, the astronomical knowledge required was not restricted to time-reckoning, but also encompassed astrometeorological knowledge of how the stars could be used to make predictions. This fact, I believe, is reflected in the organisation of these texts.

2. Using Weather Signs

David Sider's views, discussed above, on how the weather signs of the *De Signis* could be used are typical of those held in modern scholarship.[32] The standard scholarly approach is, it seems, based on two key assumptions: (1) That all weather signs are presented in line with a 'Hesiodic' model of observation (and would therefore operate a sign-to-text system) and (2) that the weather signs operated as an entirely independent and self-contained prediction method. This view, that the organisation, and thus imagined use, of weather signs was directly reliant on the operation of another predictive method, has not been argued for before. It will be my contention here that the weather signs of the *De Signis* and the *Phaenomena* are structured in such a way as depict the use of weather signs alongside, and with reference to, astrometeorological observations. By doing this, I will argue that both the assumptions about weather signs in modern scholarship are incorrect.

[31] Lehoux (2007) 12.
[32] Most commentators on weather sign passages are happy either to describe their function and use in very general terms; Kidd (1997) 438, for example, states that they are for "forecasting particular weather changes" through "observation of the appearance" of various natural phenomena. Other scholars do not discuss their use at all – presumably assuming that describing them as "weather signs" is sufficient to suggest function and thus use – which I take to be the simplest form of observation; the 'Hesiodic' method.

My intention is to be much less prescriptive than previous investigators of this idea have been. As Cronin[33] has pointed out, a number of scholars have searched for the influence of parapegmatists in the *De Signis* and apparently found evidence of Democritus, Euctemon, and Eudoxus. Cronin has argued for an absence of the influence of parapegmatists by reading the *De Signis* against the calendar attached to Geminus' *Isagoge*, which is heavily attributive.[34] The approaches of these scholars were, I fear, too narrow; they looked for the influence of specific authors on this text. Not enough is known about the work of these ancient figures, including whether or not they were even "parapegmatists" at all,[35] to make firm conclusions. The range of the findings of the modern scholars discussed above and the conflicts their results suggest tell us that this method is just not good enough to yield useful analytical results. Therefore, my focus here lies not with "parapegmata", a term which we should really use only for specific texts and inscriptions,[36] or particular parapegmatists, but with the influence of astrometeorology more generally.[37]

Since Cronin's article 1992 article[38] argues against the presence of parapegmatists in the *De Signis*, it is only right that I begin by addressing some of the points that it makes. Cronin essentially argues that the *De Signis* does not display features suggesting that it was influenced by post-fifth century astronomy and astrometeorology (this is what is characterised by his use of the word "parapegmatists") and is instead indebted to a much earlier, Hesiodic method, discussed above as "popular-practical" astronomy. He summarises his key points as follows:[39]

> "…he [the author of the *De Signis*] has been shown to differ from them [the parapegmatists] on the following points: (a) his use of ἀνατολή for ἐπιτολή (only Callippus giving him support here), (b) his attribution to Arcturus of a unique status as a weather sign, (c) his exclusive use of the singular Πλειάς and (d) his slipshod bisection of the solar year."

First, it must be pointed out that by "parapegmatists", Cronin is referring to one or more of the following: Euctemon, Democritus, Eudoxus and Callippus. There is no evidence to suggest that we should view these men as a group or that their aims, methods and ideas were in some way unified. Indeed, as I shall demonstrate later, their

[33] Cronin (1992) 312.
[34] *Attributive* parapegma "link specific predictions to particular astronomers by name" – Lehoux (2007) 19.
[35] Lehoux (2007) 21-3.
[36] On which see Lehoux (2007) *passim.*
[37] Lehoux (2007) 21 has demonstrated that it is important that we distinguish between these two things. Evidence of astrometeorology is not evidence of a parapegma.
[38] Cronin (1992).
[39] Cronin (1992) 326.

astronomical details often disagreed. To move now to Cronin's points: (a) Here Cronin looks towards the division between ἀνατολή (meaning a daily astral rising) and ἐπιτολή (for a seasonal astral rising), as they are employed in a number of the attributions that appear in parapegmata.[40] The *De Signis* appears to use the words interchangeably, and thus, he argues, reveals no connection with the parapegmata. As Cronin himself admits,[41] however, Callippus', as well as Aristotle's and Theophrastus', use of these words is the same as the author of the *De Signis*, employing them interchangeably. We can therefore swiftly modify Cronin's conclusion to state that the author of the *De Signis* does not agree with some authorities (specificially Euctemon and Eudoxus, and perhaps Democritus and Meton, though there is insufficient evidence to conlude on these latter two), but agrees with others (Callippus, Aristotle, Theophrastus). Cronin's study does not, after all, take in all early Greek astronomical authorities cited or referred to in the parapegmatic tradition;[42] (b) Cronin here refers to the fact that the author of the *De Signis* lists the meteorological significance of both the heliacal and acronychal risings of Arcturus, but of the heliacal only for the Pleiades, Sirius and Orion. Euctemon and Eudoxus, he says, give meteorological significance to both risings of the Pleiades and Sirius.[43] While this is true, we cannot overlook the fact that firstly, Euctemon and Eudoxus do often give meteorological significance to different things from one another. So, for instance, Euctemon sees the setting of Aquila as a sign of a storm, but Eudoxus apparently does not.[44] And secondly, that in Aristotle's *Meteorologica*, like the *De Signis*, it is only the heliacal rising of Orion that is given meteorological significance (*Mete.*2.5; 361b23); no reference is made to the acronychal. Once again, then, I think Cronin has overstated his findings. It is entirely possible that the author of the *De Signis* is simply using a set of astrometeorological information that varies from what is extant in the form of parapegmata.

Point (c) is fairly easily dismissed. Cronin surveys Aristotle, Theophrastus and the Geminus parapegma for the frequency with which the singular (a collective name) and plural forms of 'Pleiades' are used. While his results may well suggest a difference in practice between the Peripatetic writers and the "parapegmatists", this is not an absolute conclusion. The fact that all three do not exclusively use one term and that Euctemon is credited with only two references to Pleiades, one singular, one plural, suggests to me

[40] Cronin (1992) 315.
[41] Cronin (1992) 315-6.
[42] For a list of whom, see Lehoux (2007) 21-2.
[43] Cronin (1992) 319.
[44] On the 28th day of the Sun passing through Cancer – see this entry in the Geminus parapegma: lines 9-10 of Manitius (1908) pp.212. Differences between astrometeorological sources will be discussed more below.

that actually, the two terms are largely interchangeable. For point (d) Cronin compares the division of the year supposedly used by Euctemon and Eudoxus (which employs the equinoxes and solstices[45]) with that described by the author of the *De Signis*, which uses the equinoxes and solstices in conjunction with the risings and settings of the Pleiades. He argues that the special use of Pleiades here by the author of the *De Signis* "makes it difficult to see him as one strongly influenced by Euctemon or Eudoxus or indeed by the parapegmatists in general".[46] Eudoxus and Euctemon, however, appear to have been aiming to define the lengths of the astronomical seasons. The author of the *De Signis* is not doing this; he is observing one of the large-scale meteorological patterns that operate within a given year, for which the Pleiades need to be added. Further to this, as discussed above, the author of the *De Signis* appears to operate a five-season system. It is not surprising, then, to see no direct influence of these two ancient authorities occurring here.

Generally, then, I feel Cronin's conclusions are vastly overstated; where he writes "the parapegmatists", what he usually actually means is "one or two of a set of specific ancient astrometeorologists". His evidence does not preclude the possibility that astrometeorology influenced the *De Signis*. As I have suggested here, it is virtually impossible to detect the influence of specific authorities on astrometeorology who have been incorporated into the parapegmatic tradition. Instead, therefore, my approach will be much broader and will consider these authorities simply as exemplifying the type of astrometeorology being practiced. I will begin, however, by describing the role astrometeorology is shown to play within the *De Signis* and the *Phaenomena* lists.

The Astrometeorology of Weather Signs

The *De Signis* begins by making the division between terrestrial prediction and astrometeorology. As I discussed above, we are told that to understand the meteorological significance of the stars, the reader must consult astronomers (*DS.*1):

> τὰ μὲν οὖν ἐπὶ τοῖς ἄστροις δυομένος καὶ ἀνατέλλουσιν **ἐκ τῶν ἀστρονομικῶν** δεῖ λαμβάνειν.
>
> "Those signs, then, that have to do with the stars as they set and rise must be learned **from astronomers**".

A little more detail is added at *DS.*2, where specific constellations are mentioned:

[45] For details see Dicks (1970) 88 and 175.
[46] Cronin (1992) 325.

> αἱ μὲν οὖν τοῦ Ἀρκτούρου λεγόμεναι ἀνατολαι ἀμφοτέρως συμβαίνουσιν· ἡ μὲν γὰρ τοῦ χειμῶνος ἀκρόνοχός ἐστιν, ἡ δὲ μετοπωρινὴ ἑῴα. τῶν δ' ἄλλων αἱ πλεῖσται τῶν ὀνομαζομένων ἑῷαι οἷον Πλειάδος καὶ Ὡρίωνος καὶ Κυνός.
>
> "The frequently mentioned risings of Arcturus occur at both times: Its winter rising is acronychal[47], its fall rising occurs at dawn. But the majority of other risings of the name constellations occur at dawn, such as the Pleiades, Orion and Sirius."

Here, we see references made to Arktouros, the Pleiades, Orion and Sirius. Cronin is quite correct, I think, to argue that these constellations are mentioned here because they have a traditional meteorological function.[48] Despite the fact that the *De Signis* is explicitly not concerned with astrometerology, then, it actually begins by demonstrating the author's knowledge in this topic. In fact, it could be further argued that by outlining astrometeorological techniques first and referring to the terrestrial signs as "the remaining signs", τα λοίπα σημεῖα, the author of the *De Signis* reveals the fact that the preferred method of weather prediction is astrometerology, with terrestrial prediction almost a supplement to this system.

Unsurprisingly, Aratus' *Phaenomena* provides us with a slightly fuller picture of astrometeorology. In this text, seven constellations are described as having some meteorological significance: the Lion is a sign of wind (lines.149-153); the Kids are a sign of a storm (158); Capricorn is associated with southerly winds (293); the Eagle with storms (315); the Altar with storms and southerlies (409ff); the Centaur denotes wind (431); and Arktouros is connected also with storms (746). The Lion can provide us here with a typical example of the astrometeorology in this poem:

> ἔνθα μὲν ἠελίοιο θερείταται εἰσι κέλευθοι·
> αἱ δέ που ἀσταχύων κενεαὶ φαίνονται ἄρουραι
> ἠελίου τὰ πρῶτα συνερχομένοιο Λέοντι.
> τῆμος καὶ κελὰδοντες ἐτήσιαι εὐρέϊ πόντῳ
> ἀθρόοι ἐμπίπτουσιν, ὁ δὲ πλόος οὐκέτι κώπαις
> ὥριος. εὐρεῖαί μοι ἀρέσκοιεν τότε νῆες,
> εἰς ἄνεμον δὲ τὰ πηδὰ κυβερνητῆρες ἔχοιεν.
>
> "This [under the hind legs of the Crab] is where the sun's track is hottest, and the fields are seen without their corn-ears when the sun first comes into conjunction with the Lion. This is the time when the whistling Etesian winds sweep strongly across the broad sea, and it is no longer seasonable for ships to be under oars. Then let broad-beamed ships be my pleasure, and let helmsmen hold their oars into the wind."
>
> - *Phae.*149-155

[47] When it is first visible on the eastern horizon just as the sun sets.
[48] See Cronin (1992) 325 for parallels with Hesiod.

Here, we see the significance of the constellation framed in two ways. Firstly, it is meteorological in a general sense; we are told that the Etesian winds will blow forcefully. Secondly, its significance is tied explicitly to a practical application; sailing. It is a striking feature of the descriptions of these constellations that as part of their meteorological function, they are all but one, the Centaur, explicitly described in terms of the information they provide to sailors or framed within a maritime setting. These nautical points are the only occasions in the astronomical section of the poem at which a practical application is assigned to the stars. I will return to discuss the significance of these later.[49]

The authors of both texts, then, reveal a knowledge of astrometeorology. I want to turn now, therefore, to briefly outline exactly what information astrometeorology provided to its ancient Greek users. To do this, I will analyse the literary parapegma attached to Geminus' *Isagoge*. This parapegma provides us with the fullest picture of astrometeorology at the closest possible date to the *De Signis* and *Phaenomena*; Lehoux has recently argued that the actual construction of the parapegma probably predates the second century BC[50] and the ancient astrometeorological authorities cited are, as discussed above, Euctemon, Democritus, Eudoxus and Callippus, providing us with information from a date range of around 460 – 300BC. Let us take, then, a typical entry in this parapegma:

> ἐν μὲν οὖν τῇ α΄ ἡμέρᾳ Εὐκτήμονι Κύων μὲν / ἐκφανής, πνῖγος δὲ ἐπιγίνεται· ἐπισημαίνει.
>
> "On the 1st day, according to Euctemon, the Dog is visible; stifling heat follows; there is a change in the weather."
>
> - 212.16-17[51]

This entry tells us that according to Euctemon, on the first day that the sun is in Leo, Sirius is visible and stifling heat follows. The entry finishes with the word ἐπισημαίνει. Since this term is common in Greek parapegmata and astrometeorological texts, and will therefore reoccur in this thesis, it is important to offer a brief discussion of it here. Lehoux[52] has given the term its fullest treatment to date and argues that in parapegmatic contexts, it carries the sense of change rather than its fundamental root meaning of

[49] See pp.90-5.
[50] Lehoux (2007) 157.
[51] In the absence of a standardised formula for referencing this parapegma, I give the page and line numbers from Manitius (1908), the main critical edition.
[52] Lehoux (2004).

signification. He has shown that the noun ἐπισημασία frequently refers to a process of change, and that this is especially true in astrometeorological contexts in which the notion of signification simply does not make sense.[53] Similarly, he has shown that change is indicated when ἐπισημαίνει is used in other contexts, particularly within medicine and the natural sciences more generally.[54] For these reasons, I follow his understanding of the term, which is that it means "there is a change [in the weather]". We thus witness in this parapegma entry two significant features characteristic of their meteorological content. Firstly, as Lehoux has rightly demonstrated, the predictions made are concrete;[55] the entry states that there *will* be a stifling heat on this day. Secondly, the meteorological information appears devoid of a specific practical context. There is no connection made, for example, between this meteorological situation and the tasks that must be completed by farmers, such as we find in Hesiod and, to a certain extent, Aratus.

But what types of weather is astrometeorology primarily concerned with? The Geminus parapegma presents us with a variety of weather types, but certain key groupings do emerge. The meteorological language in that parapegma is presented below:

General Category	Words included	Number of Occurrences
'Change in weather'	ἐπισημαίνει	22
Cold	ψύχη	1
Fair	εὔδιος	2
Frost	πάχνη	1
Hail	χάλαζα	2
Heat	πνῖγος	1
Lightning	ἀστραπή	1
Rain	Various forms of ἐφύω and ὕω; ὑετός; ὕδωρ; ψεκάς	25
Snow	νιφετός	1
Storms	Numerous words with the form -χειμ-	27
Thunder	βροντή; επιβροντάω	3
Wind	νότος; ἐτησίαι; πνεῦμα; πνευματώδης; ἄνεμος; Βορεάς; ὀρνιθίαι; Ζέφυρος	46

The results here reveal an overwhelming meteorological interest in the various winds, the prediction of storms, and the prediction of forthcoming rain. In addition to this, there is a high frequency of occurrence of the word ἐπισημαίνει, discussed above. Using the characteristics of astrometeorology observed here, I want to turn now to tackle the key

[53] Lehoux (2004) 81-2.
[54] Lehoux (2004) 80-1; 83.
[55] Lehoux (2004) 80.

question of how astrometeorology and weather signs are depicted as interacting in the lists of the *De Signis* and *Phaenomena*.

I will begin by looking at the beginning of the very final passage of Aratus' *Phaenomena*, quoted here in full:

τῶν μηδὲν κατόνοσσο. καλὸν δ' ἐπὶ σήματι σῆμα
σκέπτεσθαι· μᾶλλον δὲ δύειν εἰς ταὐτὸν ἰόντων
ἐλπωρὴ τελέθοι, τριτάτῳ δέ κε θαρσήσειας.
αἰεὶ δ' ἂν παριόντος ἀριθμοίης ἐνιαυτοῦ
σήματα συμβάλλων εἴ που καὶ ἐπ' ἀστέρι τοίη
ἠὼς ἀντέλλοντι φαείνεται ἢ κατιόντι,
ὁππoίην καὶ σῆμα λέγοι. μάλα δ' ἄρκιον εἴη
φράζεσθαι φθίνοντος ἐφισταμένοιό τε μηνὸς
τετράδας ἀμφοτέρας· αἱ γάρ τ' ἄμυδις συνιόντων
μηνῶν πείρατ' ἔχουσιν, ὅτε σφαλερώτερος αἰθὴρ
ὀκτὼ νυξὶ πέλει χήτει χαροποῖο σελήνης.
τῶν ἄμυδις πάντων ἐσκεμμένος εἰς ἐνιαυτὸν
οὐδέποτε σχεδίως κεν ἐπ' αἰθέρι τεκμήραιο.

"Ignore none of these signs. It is good practice to observe one sign after another. If two agree, it is more hopeful, while with a third you can be confident. You should count the signs all the time through the passing year, checking whether, at the rising or setting of a star, such a day appears as the sign predicts. It can be particularly reliable to watch both the fourth last day of the waning month and the fourth of that just begun: for these contain the boundaries of the month's convergence, when the sky on eight nights is more imprecise, lacking the yellow moon. If you have watched for these signs all together for the year, you will never make an uninformed judgement on the evidence of the sky."

- *Phae*. 1142-1154

This passage, I suggest, contains what is needed to understand the relationship between astrometeorology and prediction through terrestrial signs as we have them in the *Phaenomena* and *De Signis*. It begins by advising us that to be confident about the predictions we make from terrestrial weather signs (the τῶν of line 1142 referring back to the weather signs that immediately preceded it) we should aim to collect together two or three signs of the same weather (1142-1144). Here, it seems to me that a deliberate counting motif develops. Firstly, we have the instruction to observe one sign after another (…ἐπὶ σήματι σῆμα / σκέπτεσθαι).[56] What comes next is the explicit mention of specific numbers (δύειν… τριτάτῳ…). These two features placed together build up the distinct impression that what we should be doing is accumulating signs and counting to keep check of how many agreeing signs we have. Next, we are told to "count the signs all the

[56] I agree with Kidd that this is the force of ἐπί here. See Kidd (1997) 507 for comments on the parallel phrase ἐπί ὕδατι ὕδωρ.

time through the passing year". But there is an issue at stake here; what exactly are these signs?

The fundamental problem with clearly understanding this statement is the ambiguity of the word 'sign', σῆμα, the most prevalent noun in the *Phaenomena*.[57] The majority of uses of this term in the *Phaenomena* can be broken up into two categories: that in which σῆμα refers to a constellation, star, or group of stars, and that in which it refers to a weather sign. So, for example, at line 608, σῆμα is used to define the constellation Bootes: μέγα **σῆμα** Βοώτης, "great **constellation** Bootes". But at line 909, a swelling sea is described as **σῆμα**...ἀνέμοιο, a "**sign** of wind", and at 1036-7, in the midst of the weather sign list, Aratus asks τί τοι λεγω ὅσσα πέλονται/ **σήματ'** ἐπ' ἀνθρώπους; "why list all the **signs** that are available to men?". The term, then, is an inherently ambiguous one, but one that is certainly the standard language of weather signs. In the *De Signis*, the form and function of weather signs are described with the same terminology of 'signs' that 'signal'. So we find statements like:

εὐδίας δὲ **σημεῖα** τάδε,

'These are the **signs** of fair weather', and

ἅλως δὲ ἐὰν ὁμαλῶς παγῇ καὶ μαρανθῇ εὐδίαν **σημαίνει**,

'If a halo forms and fades away evenly is **signals** fair weather'

(both *DS*.51).

The meanings of σῆμα more widely in Greek are, of course, very broad and numerous indeed. A search in LSJ reveals that to Homer it tends to mean 'tomb' or 'grave', and that it can have specific meanings in particular contexts, such as being a marker to indicate the distance of a javelin throw, or the decoration on a shield. All these meanings have at their core the same basic idea of something that indicates or marks, but how we are to understand them is heavily affected by context.

Kidd argues that the σήματα mentioned in line 1146 are constellations,[58] but I cannot agree with this. Firstly, I think ἀριθμοίης here picks up on the idea of counting that I have argued is developed in the preceding lines, referring to the practice of collecting together a number of prognostic weather signs. And secondly, reading σήματα here as 'constellations' results in the following lines becoming somewhat nonsensical. The passage requires us to compare, συμβάλλω, the significance of the σήματα, as

[57] Forms of σῆμα appear 45 times in the *Phaenomena.*
[58] Kidd (1997) 574.

denoted by the phrase ὁππoίην καὶ σῆμα λέγοι, with the timings of the risings and settings of the stars, που καὶ ἐπ' ἀστέρι τοίη / ἠὼς ἀντέλλοντι φαείνεται ἢ κατιόντι. There appears to be an antithesis here between the σήματα and the stars, which becomes meaningless if we read σήματα as 'constellations'. The process described here, then, appears to be that the reliability and significance of terrestrial weather signs are in some way referenced or tested against astrometeorological observations. Above, I suggested that we can see a similar process being carried out with Aratus' 'relative' use of the crane as a marker of time. We find other, very similar instances of this in the *Phaenomena.* At vv.1064-7, for example, the timing for the onset of winter is described:

> αὐτὰρ ὅτε σφῆκες μετοπωρινὸν ἤλιθα πολλοὶ
> πάντη βεβρίθωσι, καὶ ἑσπερίων προπάροιθεν
> Πληιάδων εἴποι τις ἐπερχόμενον χειμῶνα,
> οἷος ἐπὶ σφήκεσσιν ἑλίσσεται αὐτίκα δῖνος.
>
> "Now when in autumn wasps swarm excessively everywhere, even before the setting of the Pleiades, one can tell the onset of winter, such is the whirling that suddenly swirls among the wasps."

Here, the 'absolute' marker of winter is identified as the setting of the Pleiades. However, an irregular winter can be predicted by the swarming of wasps. Their swarming is only significant, however, when observed in relation to the astronomical evidence. This confluence of the astronomical signs and the terrestrial signs is summarised by Aratus in his closing lines, in which he says one must observe all the signs, τά πάντα, all together, ἄμυδις.

What is developing here is the impression that the terrestrial signs in the *De Signis* and the *Phaenomena* are underlaid by a large body of astronomical knowledge; both time-reckoning and astrometeorological. Further credence is given to this suggestion by the ancient scholium on *Phaenomena* line 752, which states that Aratus, like many past astronomers, knew about the use of a tablet, πίναξ, which tracks the movement of the sun and describes weather features like the wind:

> δεξάμενοι τοίνυν οἱ μετ' αὐτον ἀστρονόμοι πίνακας ἐν ταῖς πόλεσιν ἔθηκαν περὶ τῶν τοῦ ἡλίου περιφορῶν τῶν ἐννεακαιδεκαετηρίδων, ἀριθμήσαντες ὅτι καθ' ἕκαστον ἐνιαυτὸν τοιόσδε ἔσται χειμών, καὶ τοιόνδε θέρος, καὶ τοιόνδε φθινόπωρον, καὶ τοιοίδε ἄνεμοι, καὶ ἄλλα πολλὰ πρὸς βιωφελεῖς χρείας τοῖς ἀνθρώποις. ἐπειδη οὖν ἤδη ταῦτα ἐγνώσθη ἐκ τῶν πινάκων, καὶ αὐτὸς ἐκεῖθεν ἔγνω τὰ πολλὰ ὁ Ἄρατος... [59]

[59] Text from Martin (1974) 381.

> "So astronomical tablets were set up in the cities showing the nineteen year cycle of the sun, tracking for each year how the winter will be, and the summer, and autumn, and the kind of winds, and many other things associated with men's livlihoods. Therefore since these things are known from the tablets, and Aratus himself knew all this from them…"

Cronin has suggested that this'tablet' refers to a parapegma.[60] While this certainly seems to be the case, the *Phaenomena* itself does not reveal knowledge of physical, inscriptional parapegmata. Instead, we can take this scholium as a suggestion that later scholars working on the *Phaenomena* believed that Aratus knew about astronomical time-reckoning and astrometeorology.

We can now, therefore, begin to sketch out a much fuller picture of how the weather signs in the *De Signis* and the *Phaenomena* are depicted as operating. We have seen that astronomical observation appears to provide, in many cases, the 'absolute' indicators on which the terrestrial signs are built and against which they are compared. I suggest, therefore, the following two-step process for their use:

> (1) Astrometeorology provides weather predictions for the set specific day, e.g. 'storm expected'.
>
> - If the source of astrometeorological information is in parapegmatic form, then the scheme for observation is: relevant peg or date observed > stellar phase usually given > prediction given.[61]
>
> (2) Using this information, the weather signs for that type of weather are looked out for.

This method avoids one of the problems I discussed above about the number of weather signs one has to observe at any one time. Instead of being on the lookout for everything and anything that may carry some sort of significance, the astrometeorological information allows particular the observer to narrow their focus and identify which set of signs are meaningful on that particular day. Thus, the important direction of movement here is from text to sign, rather than from sign to text. This way of using weather signs comes across also in the structures of the lists of signs in both these texts. It is this that I turn to now.

The Structure of the De Signis *and the* Phaenomena

[60] Cronin (1992) 313 n.7.
[61] Adapted from Lehoux (2007) 68, which provides a fuller model for the use of parapegmata.

The *De Signis* is structured in four broad sections, arranged by event. These deal with signs for rain (10-25), winds (26-37), storms (38-49) and of fair weather (50-5). In addition to this, there is, at the end, a short section of miscellaneous signs that make a number of long-range predictions (56-7), on which we will focus later. Sider and Brunschön have quite rightly observed that within these main 'chapters', a certain pattern emerges; each starts with signs derived from the sun and moon, before descending into a "jumble of signs derived from comets, clouds, thunder and lightning , rainbows and other meteorological oddities, mountain tops, lamps, insects, birds, spiders, worms, frogs, and mammals".[62] The greater part of the *De Signis*, then, consists of unorganised signs of no particular unified type or characterisation. This fact makes it even more striking that each chapter begins, without fail, by discussing signs from first the sun and then the moon. Since the organisation of the other signs appears to be so random, when we consider the rigid placement of the sun and moon, we can justifiably view this as evidence of a deliberate and considered decision. We can, I think, find the beginning of a reason for this decision rooted in the prologue to the *De Signis* (*DS.*5), in which the signs taken from the sun and moon are described as the "best" (μάλιστα) in comparison to those from animals. I shall return to discuss the significance of this description shortly.

The structure of Aratus' section on weather signs is a little more complicated than that of the *De Signis*. He does not order by type of sign or type of weather, but a mixture of the two. It begins with a section that outlines 'celestial' signs. Included are those from the moon (*Phae.*778-818), the sun (819-891) and of the visibility of the constellation Manger (892-908), before turning to signs for predicting winds (909-32), then rain (993-87), then fair weather (988-1012), storms (1013-43), and finally signs linked to longer-range seasonal predictions and specific occupations, comprising general seasonal signs (1044-63), winter signs (1064-93), summer signs (1094-1103) and signs taken from occupations (1104-41). The organisation of Aratus' poem outlined here has caused, to the few modern scholars who have worked on it, some confusion. Sider and Brunschön simply ignore Aratus' ordering, arguing that as a poet, he was free to "arrange signs idiosyncratically".[63] Douglas Kidd finds the structure puzzling, describing it as he does as "complicated and rather confusing".[64] However, when we read Aratus in the context of the discussion of the *De Signis* above, the order of the weather signs perhaps begins to seem a little less baffling.

[62] Sider & Brunschön (2007) 34.
[63] Sider and Brunschon (2007) 34.
[64] Kidd (1997) 439.

What is most obvious about Aratus' organisation is, as I have already stated, that he discusses weather signs both in terms of type of sign and in terms of type of weather. As we have seen suggested from evidence taken from the *De Signis*, there appears to be a link between a conceptualised hierarchy of the quality of signs, and particularly the sun and moon, and their treatment in prognostic lists. While it could be argued that such an individual thought process could not be extended beyond one author, it is striking that in the *Phaenomena* the set of signs that are separated from others, in that they are discussed as signs rather than by weather type, and appear first in Aratus' list are those derived from the moon, the sun and the Manger. [65] It appears to be the case, then, that Aratus' order reflects the same ideas that are suggested by the *De Signis'* ordering; that celestial signs are in some way superior to the others and are therefore worthy of some kind of distinction or special treatment. That Aratus is working in some tradition is suggested by comments in Geminus' *Isagoge*. When summarising the second half of the *Phaenomena*, Geminus gives the order of Aratus' signs as the sun, moon, stars and animals (*Isag.*17.47). This, as we have seen, is not in fact Aratus' ordering since he begins with the moon. There must have been a reason why Geminus mis-represents Aratus' ordering. I would like to suggest that he was simply summarising the standardised ordering of weather signs, and that Aratus' order is therefore to some extent an idiosyncratic order, but only in as far as placing the moon first.[66] Aratus' complicated and confusing organisation thus becomes an explicable instance of an existing tradition of thought, which favours signs related to the heavenly bodies. Indeed, we do get a strong suggestion of this idea in Aratus' comments on signs from the sun, when he states that the sun is the most reliable provider of signs:

> …ἠελίῳ καὶ μᾶλλον ἐοικότα σήματα κεῖται
> ἀμφότερον δύνοντι καὶ ἐκ περάτης ἀνιόντι.
>
> "more reliable signs are present in the sun, both when setting and rising over the horizon."
>
> *Phae*. 820-1

[65] It is worth pointing out here that this pattern of organisation we have witnessed so far was not, however, restricted just to those authors who set about to specifically discuss weather signs as a substantial part of their work: as we will see later, Lucan's *Pharsalia*, Vergil's *Georgics* and Pliny's *Natural History* all reveal a favouring of the ordering system we have witnessed here.

[66] Indeed, there does seem to be some preference on Aratus' part that perhaps makes him put the moon first; his famous acrostic, for example, (783-7) appears in the moon sign sections, perhaps indicating some interest in lunar matters. I do not have a satisfactory explanation for this apparent preference, other than Aratus maybe had a particular personal fondness for the moon.

But what exactly does all this mean? As Sider and Brunschön have noted, it is not entirely clear what causes this hierarchical idea in the context of the *De Signis*; in the words of the *De Signis*, what constitutes "the best signs" they ask.[67] A potential answer to this question may lie, I think, in a closer analysis of the groupings of the weather signs in the *Phaenomena*.

'The Best' Weather Signs

Fundamentally, what needs to be asked here is what it is that makes signs from the sun, the moon and, in the *Phaenomena*, the Manger, different from those taken from other sources. To answer this question, I will take the opening lines from each of Aratus' groups as sample passages; one from the section on the moon, one from the sun, one from the Manger and one from the section on wind (which will here stand for the sections on wind, rain, fair weather and storms):

The moon *(Phae*.778-787):

> σκέπτεο δὲ πρῶτον κεράων ἑκάτερθε σελήνην.
> **ἄλλοτε γάρ τ' ἄλληι μιν ἐπιγράφει ἕσπερος αἴγλη,**
> **ἄλλοτε δ' ἀλλοῖαι μορφαὶ κερόωσι σελήνην**
> **εὐθὺς ἀεξομένην, αἱ μὲν τρίτηι, αἱ δὲ τετάρτηι·**
> τάων καὶ περὶ μηνὸς ἐφεσταότος κε πύθοιο.
> λεπτὴ μὲν καθαρή τε περὶ **τρίτον ἦμαρ** ἐοῦσα
> εὔδιός κ' εἴη· λεπτὴ δὲ καὶ εὖ μάλ' ἐρευθὴς
> πνευματίη·
>
> "Observe first the moon at her two horns. **For different evenings present her with different light, and different shapes horn the moon at different times as she waxes – some on the third day, some on the fourth.** From these one may learn about the establishing month. If she is slender and clear around the **third day**, she indicates fair weather. If slender and very red, she indicates wind."

The sun (*Phae*.819-824):

> ἠελίοιο δέ τοι μελέτω ἑκάτερθεν ἰόντος·
> ἠελίωι καὶ μᾶλλον ἐοικότα σήματα κεῖται
> **ἀμφότερον δύνοντι καὶ ἐκ περάτης ἀνιόντι**.
> μή οἱ ποικίλλοιτο, **νέον βάλλοντος ἀρούρας,**
> κύκλος, ὅτ' εὐδίου κεχρημένος ἤματος εἴης,
> μηδέ τι σῆμα φέροι, φαίνοιτο δὲ λιτὸς ἁπάντη.
>
> "Pay attention to the sun when its path is on either side; more reliable signs are present in the sun, **both when setting and rising over the horizon**. May its circle not be spotted **when he first strikes the earth**, nor bear any mark, but appear pure all over, when you need a fine day."

[67] Sider and Brunschön (2007) 112.

The Manger (*Phae*.892-3):

> σκέπτεο καὶ Φάτνην. ἡ μέν τ' ὀλίγῃ εἰκυῖα
> ἀχλύι βορραίη **ὑπὸ Καρκίνωι ἡγηλάζει**."

> "Observe the Manger also. It, like a slight mist in the north, leads with Cancer."

Wind (*Phae*.909-915):

> σῆμα δέ τοι ἀνέμοιο καὶ οἰδαίνουσα θάλασσα
> γινέσθω καὶ μακρὸν ἔπ' αἰγιαλοὶ βοόωντες,
> ἀκταί τ' εἰνάλιαι ὁπότ' εὔδιοι ἠχήεσσαι
> γίνονται, κορυφαί τε βοώμεναι οὔρεος ἄκραι.

> "Let a sign of wind be the swelling sea and shores booming way off, whenever the rocky coasts reverberate in good weather, and high peaks of mountains rumble."

What is noticeable about these passages is that when introducing each new section, for the moon, sun and Manger, the first listed weather sign related to that source is not the first thing appears in that section. So, for example, in the moon passage above, the first weather sign appears not at line 778, but is delayed until 783 ('if slender and clear about the third day, she indicates good weather').This is not the case, however, for the passage on wind; it goes straight into the list of signs. What delays the signs in the other passages is a discussion or description centred around time. So the moon section begins by stating that the moon appears different according to the particular evening at which it is observed and that its shape changes while it waxes. And the day on which it is observed, we are told, affects what it signifies.

The section on the sun tells us that it is the most reliable (μᾶλλον ἐοικότα) "both when setting and when rising over the horizon". And that again, the time at which it is observed affects the meaning of its signs, as phrases like 'when he first strikes the earth', νέον βάλλοντος ἀρούρας, indicate. The passage on the Manger also specifies the time at which it should be observed, since it seems to "lead" with the constellation Cancer, ὑπὸ Καρκίνωι ἡγηλάζει. Kidd has elucidated this curious phrase by explaining that the scheme for the Aratean year appears to be based on an Athenian year that begins with the summer solstice, at which time the sun enters Cancer.[68] These sets of signs then, appear to stress the importance of knowing <u>when</u> to look for them. This is not the case with the signs for wind, rain, fair weather and storms. For these groups, the large number of relevant signs is simply listed. In the example taken from the winds above, there is no suitable time to observe these signs specified. I believe it to be the case, therefore, that the signs taken from the sun, moon and the Manger are individualised and treated as the

[68] Kidd (1997) 471 with 374.

'most reliable' because they have fixed, guaranteed timings at which they can be observed. It is always a certainty that the sun will rise every day, or that the Manger will appear at the same location in the sky and for the same duration every year. This is not the case with the signs taken from animals or other similar sources, the observation of which is almost purely down to chance. To this issue of regularity of appearance, I shall return shortly. We may quite reasonably ask, then, when we are meant to look out for these sets of signs; all the time? No. Using the scheme of observation I outlined above, we know on which days we should be looking out for which signs. The astrometeorology, then, provides the timing information for the wind, rain, fair and storm groups that is internally built into the 'celestial' signs. This fact accounts, I think, for the way in which these signs are grouped; the organisational grouping that Sider and Brunschön saw as so desperately impractical, is therefore actually not.

Further to this, we can state that not only does astrometeorology theoretically appear to provide this information, but that it actually *could*. Above, I tabulated the meteorological concerns of the parapegma attached to Geminus' *Isagoge*. From that data, it could be identified that the astrometeorology represented by that parapegma had its primary concerns with the prediction of winds, storms, rain and generic change. From the groupings of signs in the *Phaenomena* and *De Signis* discussed above we find the same focus on the prediction of winds, storms and rain. This similarity in primary concern is not particularly surprising, given that astrometeorology and terrestrial prediction seem to have originally shared a common ancestry. The difference, of course, lies with the fact that the terrestrial signs appear to have an additional concern with the prediction of fair weather, which is of only very minor interest to astrometeorology. The inclusion of a fair weather section of signs is a very logical one, seeing as how the other sets of weather may all be considered 'bad' and that one would need to know when a change from bad weather to good weather would occur; it can be argued that for some of the time, the astrometeorological ἐπισημαίνει would indicate this change,[69] and therefore, signs signifying this would indeed be useful to catalogue.

An Alternative System?

Ordering weather signs by their significance is, of course, just one way of organising them, and we do have evidence of a different system. In the Hellenstic papyrus

[69] On which see pp.41-2 above.

P.Vindob.Gr.1,[70] sometimes referred to as the 'Wessely papyrus', we find headings that seem to suggest organisation by sign source, rather than significance. The papyrus itself is heavily fragmentary and the published texts of it are based on substantial reconstruction. What is clear, however, is that it comprises three topics; the first is a descriptive account of the planets;[71] the second list of weather signs;[72] and the third a continuous series of Greek letters representing numbers.[73] Wessely originally suggested that this list of numbers was part of a parapegma,[74] and this led him to conclude that the papyrus was a meteorological text comparing varying weather prediction techniques. In 1962, Neugebauer published his version of the papyrus and demonstrated that the series of numbers was in fact a table recording the length of the shadow cast by a gnomen (the 'finger' of a sundial) as the sun moved.[75] Thus our view of the scope and focus of the papyrus changed dramatically. As Arrighetti points out, no other extant text features the three strands of information that this papyrus does.[76]

The extant weather sign section of the papyrus appears to be divided into four sections. The identification of these sections is generally agreed upon by Wessely and Neugebauer, though one section is far from secure. The most firmly reconstructed[77] is that of a section describing the constellation the Manger; preserved on line 18 of fragment 2 is the word φατνίου, manger. Signs derived from the visibility of the Manger are typical in weather sign lists. In particular, Aratus' *Phaenomena* features a section devoted to them (lines 892-908).

Another section has been reconstructed to reveal that it contains signs from the sea.[78] A third contains signs from the sun.[79] That which begins at line 12 of fragment 3 and 4 (which are grouped together by Neugebauer) is the questionable one. As Wessely observes, this section of the fragment preserved just two significant words in full:[80] πηδᾶν, 'jumping' or 'bounding', at line 13 and ἄστρα, 'stars', at line 15. This led him to plausibly suggest that the section details signs associated in some way with shooting stars. Wessely then goes on to argue, however, that since shooting stars could be

[70] First published in Wessely (1900), before being substantially revised and rearranged in Neugebauer (1962) 29-44. For studies, see these texts and Arrighetti (1963).
[71] Neugebauer (1962) Fragment 1. I employ Neugebauer's fragment numbering throughout.
[72] Neugebauer (1962) Fragments 2 -6.
[73] Neugebauer (1962) Fragment 6, column II and fragment 7.
[74] Wessely (1900) 9.
[75] A common ancient experiment; see Evans (1998) 27-31.
[76] Arrighetti (1963) 400.
[77] See Wessely (1900) 17-22 for details.
[78] See Wessely (1900) 33-5.
[79] See Wessely (1900) 24-7.
[80] Wessely (1900) 22.

associated with storms, the papyrus section may be focused around this instead. He therefore presents two options for the title of the section: [χειμώνω]ν σημεῖα, 'signs of storms', or [διᾳττόντω]ν σημεῖα, 'signs from shooting stars'. Subsequently, the latter has found favour with Neugebauer[81] and Sider and Brunschön,[82] while Arrighetti opts for the storms.[83] Given that the other groupings in the papyrus are by sign source, not weather type, I find shooting stars to be the more probable of two options. While it is true that, as I have argued above,[84] the sun and the Manger are frequently individualised even where grouping by weather type is adopted, the inclusion of the sea in its own group would be anomalous within this scheme. Thus the three groups organised by sign source would suggest that this is the model adopted across the weather sign section of the papyrus. Having discussed some of the details of the papyrus, it is now important to ask why it is organised in this way and how this relates to the system of organisation I have outlined above.

The potential suggestion that this text is some sort of manual for observation, of the planets and of the weather, is ultimately undermined by the third column, which is a record of observations of an experiment done at a specific time and in a specific place, not a guide for performing them. Sider and Brunschön have, as mentioned above, argued that when signs are organised in the fashion demonstrated by this papyrus, it indicates a "helpful" weather guide.[85] This papyrus would seem to question their theory. Viewing this papyrus as a record of information therefore seems like a much more fruitful path to follow. Perhaps what we have here is something more akin to the presentation of collected data – some kind of reference work gathering together in one place a series of observations and pieces of information. This suggestion is made more plausible when we consider how duplicated signs can be viewed within texts like the *De Signis*. At points in that text, a specific animal, bird, action of these animals or birds, or cloud formation appears more than once, indicating different weather. For example, at *DS.*18, ducks flying under the cornice of a house and flapping their wings is taken to be a sign of rain, and thus appears in the rain section of the text. At *DS.*28, ducks appear again, indicating rain by their diving and wind by the flapping of their wings. This sign appears in the wind section. Ducks, then, can be a sign of rain or wind, depending on what they are doing. That numerous meanings can come from a single source, the most striking example of

[81] Neugebauer (1962) 42.
[82] Sider & Brunschön (2007) 15.
[83] Arrighetti (1963) 414.
[84] See p.48.
[85] Sider and Brunschön (2007) 30.

which is probably the appearance of a finch no less than four times in the *De Signis* (19; 23; 39; 40), it has been argued, suggests that they, in addition to the fact that there are clusters of groupings by sign type within the *De Signis* (for example, chapter 40 contains only signs from birds), may be the result of the fact that the author of the *De Signis* consulted source material that was organised by sign type, not weather result.[86] Thus, as Sider and Brunschön explain, "what was originally stated in the form "*x* signals *m* or *n*" would show up in *DS* as "*x* is a sign of *m*" in one place and as "x is a sign of *n*" in another".[87]

Therefore, it is more than possible that weather signs were first collected together in this sign source structure before being reorganised into a text like the *De Signis*. Sider and Brunschön accept that this process is likely to have taken place. However, as I have already noted, they also take the view that organisation by sign type is the most practical way to order weather signs for prediction. Why, though, would text with 'practical' organisation be made impractical? What is gained in this process? Sider and Brunschön do not consider this question. Rather than seeing, as they do, a practical text becoming made impractical, I instead see an impractical text, organised by signs, becoming a practical text, with its signs organised by result for the use in the way I have outlined in this chapter.

3. Understanding Weather Signs

Thus far in this chapter, I have argued that astronomical developments in the 5th century BC influenced the way weather signs were discussed and, in some cases, changed the functions they are shown to perform. I have also argued that astronomical events became the 'absolute' markers in relation to which prognostic signs were placed. This provides us with a good basis on which to start to define the positions the two methods occupied relative to one another. Between astrometeorology and weather signs, we can, I think, characterise the former as being depicted as the 'primary' method of weather prediction. Both, though, are presented in fundamentally practical forms. In my model of how the weather signs of the *De Signis* and *Phaenomena* are organised, I have argued that the first step in their use is actually the consultation of astrometeorology; it forms the central technique into which weather signs can be added. This relationship, however, requires some further analysis as the process of fitting signs into astrometeorology is not quite as simple as I have suggested.

[86] See Arrighetti (1963) 419 and 424-8 with Sider and Brunschön (2007) 30.
[87] Sider and Brunschön (2007) 30.

The focus of this next section will therefore be two important questions: (1) What was it about astrometeorology that meant it could be depicted as the central system? (2) If the relationship between the methods in this period is as I have portrayed it in this chapter, with astrometeorology emerging as the absolute method of prediction, why did it not immediately replace weather signs fully and thus eradicate them completely? Just as astrometeorology must have had features that resulted in its becoming 'dominant' in these texts, the weather signs too must have been thought to be offering something.

Why Astrometerology?: Regularity

I have argued that the factor influencing the apparent hierarchy within the weather signs, with those taken from the sun and moon often described as being the best or most reliable and therefore receiving some degree of 'preferential treatment' within the text, is the difference in the regularity of their appearances. I think we can extend this model of regularity further than just the weather signs in order to think about ancient weather prediction as a whole, and with it, the relationship between astrometeorology and prognostics.

As I outlined in my introduction, one of the main differences in the characteristics of these two methods is that while astrometeorology is based on a series of fixed events, the risings and settings of stars, which are not only guaranteed to happen but also happen at the fixed interval of one sidereal year, weather signs typically rely on chance; not only the chance that an observer will see them but the chance that they will even happen at all. I also demonstrated how central the idea of cyclicity was to ancient meteorological thought and thus, how weather signs may be seen to not fit straightforwardly with an understanding of meteorological phenomena.This is obviously disadvantageous to time-reckoning,[88] which, as I have already discussed, may have been the main impetus for early astronomical study, but it is also primarily this fact, I think, that led to astrometeorology being used as the primary, and 'absolute', method of weather prediction. We can see evidence for this opposition, of fixed predictability on the one hand and fortuitous chance on the other, in both the *De Signis* and the *Phaenomena.*

Let us begin by taking a sample passage of the *De Signis*:

> καὶ οἱ μύκητες **ἐὰν** νότια ᾖ ὕδωρ σημαίνουσι, σημαίνουσι δὲ καὶ ἄνεμον κατὰ λόγον ὡς ἂν ἔχωσι πλήθους καὶ μεγέθους, σμικροὶ δὲ καὶ κεγχπώδεις καὶ λαμποὶ ὕδωρ καὶ ἄνεμον. καὶ **ὅταν** χειμῶνος τὴν φλόγα <ὁ λύχνος> **ἀπωθῇ** διαλιπὼν

[88] Indeed, Reiche (1989) argues that the regularity of stellar phases is what made them so relied upon in ancient time-reckoning.

οἷον πομφόλυγας ὕδατος σημεῖον, καὶ **ἐὰν** πηδῶσιν αἱ ἀκτῖνες ἐπ' αὐτον, καὶ **ἐὰν** χειμῶνος ὄντος μύκαι ἐπιγένωνται.

"**If** there are winds from the south, the snuff signals rain. It also signals wind in proportion to its amount and volume, and if it is grainy like millet and shiny it signals rain and wind. When, in winter, <the lamp> throws off its flame like bubbles, it signals rain, and **if** the rays leap on it, and **if** in winter the snuff builds up."

-*De Signis* 14

This passage, that describes signs of wind taken from lamps and wick sniff, has features typical of the *De Signis* as a whole. When considering the potential place of unpredictability in this text, what is noticeable is the number of clauses that begin 'if…'. There is a clear acceptance here of the fact that the signs listed may not actually happen. One clause in this passage, however, is not directly governed by an 'if'; that of the lamp intermittently throwing off its flame. Despite this, the sense of indefiniteness is not lost. Rather than the clause beginning 'if', we instead find ὅταν with the subjunctive (ἀπωθῇ), forming an indefinite clause. This lends to the sign the same idea of unpredictability present in the others. Indeed, LSJ notes that ὅταν, when paired with something of conditional force, as is provided by the subjunctive here, renders its meaning closer to ἐάν, giving a sense of an indefinite future construction. [89] The continual use of the indefinite in relation to the weather signs indicates, I think, the fact that the irregularity of their appearance is of sufficient note to the author that he has felt it necessary to make a point of it at length. In addition to this, portraying signs in this way lends the same sense of indefiniteness, by assumption, to all the weather signs contained in the *De Signis*, whether or not they are actually within a formalised indefinite construction.[90] This indicates that we should indeed be looking to the idea of regularity and irregularity as a fundamental concern within ancient weather prediction. Ideally, one would compare this depiction of terrestrial prediction with details of astrometeorology. Since the *De Signis* does not contain sufficient information dealing with this, I propose, due to the Peripatetic origin of the *De Signis*,[91] turning to Aristotle.

We saw above that part of Aristotle's definition of meteorology was the contrast made between the celestial and the terrestrial, and specifically that terrestrial phenomena occur with less regularity (ἀτακτοτέραν) than those of the primary element, *aither*, which makes up the heavenly bodies and their spheres. What this does, therefore, is demonstrate

[89] LSJ 1264.
[90] Sider and Brunschön (2007) 34-5 have identified a number of other constructions and words that provide what they identify as 'conditionality'. These are the use of the conditional circumstantial participle; ὅλως; ὡς ἐπὶ τὸ πολύ; εἴωθε; ὡς τὰ πολλά; and (επὶ) πολύ with the verb.
[91] On which see Sider and Brunschön (2007) 4.

that astronomical phenomena, including the movements of the stars, are being viewed as being the most regular things it is possible to observe. The scepticism towards the occurrence of weather signs that the *De Signis* passage above demonstrates is thus an understandable approach; the author cannot guarantee that the signs will be available for observation like he could if he was discussing astrometeorology and the revolution of the stars. The *De Signis*, then, reflects the chance involved with weather signs, and was probably underlain by a knowledge of the rigidity of astronomical events. The emphasis on regularity of appearance I suggested being in place in the overall structure of the *De Signis* is therefore reinforced and as a result, we witness the striking fact that Aristotelian cosmological theory had influence all the way from the enormity of understanding how the cosmos is operating, right down to how lists of weather signs should be organised for use; the *De Signis* is, in part, an expression of this Aristotelian thought.

'If's are generally less prevalent in Aratus' weather sign section. That is not to say, however, that there are not still passages which are governed by an 'if', as the following passage demonstrates. Here, the indefinite force of the first 'if' sentence is connected to the rest of the passage by a series of 'μηδέ's,:

> τῶν τοι μηδὲν ἀπόβλητον πεφυλαγμένῳ ὕδωρ
> γινέσθω, μηδ' **εἴ** κεν ἐπιπλέον ἠὲ πάροιθεν
> δάκνωσιν μυῖαι καὶ ἐφ' αἵματος ἱμείρωνται,
> ἢ λύχνοιο μύκητες ἀγείρωνται περὶ μύξαν
> νύκτα κατὰ νοτίην· **μηδ'** ἢν ὑπὸ χείματος ὥρην
> λύχνων ἄλλοτε μέν τε φάος κατὰ κόσμον ὀρώρῃ,
> ἄλλοτε δ' ἀΐσσωσιν ἄπο φλόγες ἠΰτε κοῦφαι
> πομφόλυγες· **μηδ'** εἴ κεν ἐπ' αὐτόφι μαρμαίρωσιν
> ἀκτῖνες· **μηδ'** ἢν θέρεος μέγα πεπταμένοιο
> νησαῖοι ὄρνιθες ἐπασσύτεροι φορέωνται.
>
> "Let none of these warnings be ignored if guarding against rain, **not if** flies bite more than they have before and thirst for blood, nor if snuff collects on the the wick of a lamp on a damp night; **nor if** during the winter season sometimes the flame of lamps rises gradually, and sometimes the flames shoot off like airy bubbles; **nor if** the rays flash on it; **nor if** in the wide summer, island birds are on the move one after another."
>
> - *Phae.* 973-982

A sense of indefiniteness in Aratus' *Phaenomena*, however, is not just established amongst the list of signs itself; it also forms part of the overall introduction to the weather signs section. At *Phae.* 767-8 Aratus describes the prediction of bad weather at sea. During this passage, the weather signs featured in his poem are revealed to be not accurate to, or restricted by, any particular time frame:

ἄλλοτε δὲ τρίτον ἦμαρ ἐπιτρέχει, ἄλλοτε πέμπτον,
ἄλλοτε δ' ἀπρόφατον κακὸν ἵκετο·

"Sometimes the trouble comes over on the third day, sometimes the fifth, and sometimes it appears unexpectedly."

He attempts to account for the unpredictability of the weather signs by explaining that not everything sent from Zeus is known and recognised fully:

…πάντα γὰρ οὔπω
ἐκ Διὸς ἄνθρωποι γινώσκομεν, ἀλλ' ἔτι πολλὰ
κέκρυπται, τῶν αἴ κε θέλῃ καὶ ἐς αὐτίκα δώσει
Ζεύς·

"For we men do not understand everything from Zeus, but still much is hidden, of which, if he wishes, Zeus will give us."

- *Phae.*768-771

Kidd comments on this in passing, stating that it represents a brief "touch of realism"[92] within the world of the *Phaenomena*. This 'touch of realism', however, is really an acceptance that weather signs seem to be quite unpredictable. Not only are their predictions sometimes of questionable authority, as the 765-8 passage above suggests, a point to which I will return shortly, but they are not guaranteed to occur. In the above passage, Aratus tells us that much is hidden by Zeus and thus the appearance of weather signs is at his whim (αἴ κε θέλῃ), or in other words, irregular in their appearance. The placement of this statement, in the lead-in to the catalogue of signs, casts doubt over the reliability of the appearance of all the signs contained in the *Phaenomena* and presents a very similar idea of indefiniteness to that which we witnessed playing an important role in the *De Signis*.

We can contrast the unpredictability of the weather signs with Aratus' comments on the fixed nature of the stars. At 451-3, Aratus explicitly mentions the fact that the movement of the stars is regular and one can see the same constellations repeating at a fixed interval:

Ταῦτά κε θηήσαιο παρερχομένων ἐνιαυτῶν
ἑξείης παλίνωρα· τὰ γὰρ καὶ πάντα μάλ' αὕτως
οὐρανῶι εὖ ἐνάρηρεν ἀγάλματα νυκτὸς ἰούσης.

[92] Kidd (1997) *ad loc.*

> "These [constellations] you can see as the years rotate in succession; for these figures of the passing night are all well fixed in the sky."
>
> - *Phae*. 451-3

The same sentiment is expressed at the very end of the astronomical section of the *Phaenomena*:

> γινώσκεις τάδε καὶ σύ· τὰ γὰρ συναείδεται ἤδη
> ἐννεακαίδεκα κύκλα φαεινοῦ ἠελίοιο,
> ὅσσα τ' ἀπὸ ζώνης εἰς ἔσχατον Ὠρίωνα
> νὺξ ἐπιδινεῖται Κύνα τε θρασὺν Ὠρίωνος,
> οἵ τε Ποσειδάωνος ὁρώμενοι ἢ Διὸς αὐτοῦ
> ἀστέρες ἀνθρώποισι τετυγμένα σημαίνουσι.
>
> "You know these also- for already the nineteen cycles of the shining sun are celebrated together – all the stars that night turns from the belt to Orion at the end and the fierce dog of Orion, and those constellations which when seen in Poseidon's territory or Zeus' give clear signs to men."
>
> - *Phae*. 752-7

Again, here, the fixed nature of the repetitious pattern of the stars is described – the year can be thought of as starting with the rising of Orion's belt, and the beginning of the next solar year can be witnessed by the rising of the same feature. Further to this, the significance of the stars as seasonal signs is restated, providing as they do clearly defined indicators (τετυγμένα) to men. Kidd is right, I think, to see this statement of fixed reliability as standing in deliberate opposition to the statement of relative instability of weather signs,[93] as quoted above, which comes just ten lines later.

Reliability of appearance does, therefore, seem to have been a major driving force in how ancient weather prediction was written about and helps us understand what astrometeorology had that weather signs were lacking that resulted in the particular relationship I have described here. There does seem to be more, however, than just a concern for the regularity of signs. As the passage from the *Phaenomena* above reveals, we can perhaps also detect an indication of the importance of the accuracy of predictions.

Accuracy

My concern here is not, of course, with whether the signs used in antiquity were actually accurate predictors,[94] but with whether they were viewed as being so. Let us therefore begin by relooking at *Phae.* 765-8:

[93] Kidd (1997) *ad loc.*

[94] For a brief discussion of this, see Sider and Brunschön (2007) 38-9. Marriott (1981) provides a good reference source for details on the accuracy of over 1900 pieces of British weather lore, many of which have their roots in ancient signs. Currie (2010) is also interested in this question.

πολλάκι γὰρ καί τίς τε γαληναίῃ ὑπὸ νυκτὶ
νῆα περιστέλλει πεφοβημένος ἦρι θαλάσσης,
ἄλλοτε δὲ τρίτον ἦμαρ ἐπιτρέχει, ἄλλοτε πέμπτον,
ἄλλοτε δ' ἀπρόφατον κακὸν ἵκετο·

"Often on a calm night a man ties down his ship, fearing the sea at dawn. Sometimes the trouble comes over on the third day, sometimes the fifth, and sometimes it appears unexpectedly."

This passage is set within the introduction to the weather signs (758-777), which begins by stressing the importance of being aware of the weather before one takes to sea. Then comes this passage, which depicts a sailor who has secured his ship at night because a storm has been predicted for the coming dawn, presumably, from the context, by a weather sign. But, we are told, the troublesome weather may appear on the third day, or on the fifth, or may come completely unexpectedly. This statement, as discussed above, is then linked to comments on the irregularity of weather signs. Here, though, we seem to have the suggestion that predictions made from weather signs are perhaps somewhat questionable; the results they predict will happen at an unknown time and the weather signs are thus imprecise.

We can glean a similar implication from the closing passage of the *Phaenomena*:

τῶν μηδὲν κατόνοσσο. καλὸν δ' ἐπὶ σήματι σῆμα
σκέπτεσθαι· μᾶλλον δὲ δύειν εἰς ταὐτὸν ἰόντων
ἐλπωρὴ τελέθοι, τριτάτωι δέ κε θαρσήσειας.
αἰεὶ δ' ἂν παριόντος ἀριθμοίης ἐνιαυτοῦ
σήματα συμβάλλων εἴ που καὶ ἐπ' ἀστέρι τοίη
ἠὼς ἀντέλλοντι φαείνεται ἢ κατιόντι,
ὁππoίην καὶ σῆμα λέγοι...

"Ignore none of these signs. It is good practice to observe one sign after another. If two agree, it is more hopeful, while with a third you can be confident. You should count the signs all the time through the passing year, checking whether, at the rising or setting of a star, such a day appears as the sign predicts…"
- *Phae.* 1142-8

Here, as I have already noted above, we are told that to make confident predictions from weather signs, numerous signs should be collected together and their predictions referenced against astrometeorological predictions. The fact that two or three signs are required to be confident (θαρσήσειας) implies that a single sign observed in isolation cannot be trusted. We therefore get, again, something of an indication pointing towards the fact that weather signs were often depicted as generally of questionable reliability with regard the accuracy of their predictions. It is for this reason that (1) numerous

agreeing signs have to be taken into consideration and (2) the prediction made by weather signs should be checked against the astrometeorological forecast. The implication that can be taken from this is that the astrometeorological predictions are sufficiently trustworthy in their own right to act as the yard-stick.

The *De Signis* also demonstrates a concern over the accuracy of the predictions that can be made. I give here two passages, both of which emphasise the need to be aware of and use the most accurate signs possible. In the first, the importance of local knowledge is stressed:

> διὸ δεῖ προσέχειν οὗ ἄν τις ἱδρυμένος ᾖ. ἔστι γὰρ αἰεί τινα λαβεῖν τοιοῦτον γνώμονα καὶ ἔστι **σαφέστατα** τὰ σημεῖα τὰ ἀπὸ τούτων.
>
> "It is necessary to note where a person is located. For it is always necessary to find such a knowledgeable person and the signs from these people are always the most accurate."
>
> -*DS.* 3

Here, we are told that consulting with local experts is the best way to find out the most accurate (σαφέστατος) signs for that particular area. That weather signs originally began as regionally-specific and that many remained so has been demonstrated above. What this passage does is to highlight the fact that not all weather signs appear to provide equally accurate predictions. This idea is repeated in the second passage:

> καὶ ἐὰν ῥάβδοι νοτόθεν, ταὐτὰ δὲ ταῦτα βορρᾶθεν γινόμενα **ἀσθενέστερα**.
>
> "Also [a sign of rain] if there are rays are to the south, but if these are to the north they are less secure."
>
> -*DS.* 11

Here again, certain signs, streaks of light appearing to the south, can provide reliable predictions, whereas others, streaks of light appearing to the north, are less secure (ἀσθενέστερος). Exactly what the measure of this accuracy is in either of these texts, is not clear; perhaps the observation that certain signs are generally more accurate because their predictions are correct a higher percentage of time than other signs. Because of this lack of information, it is difficult to characterise precisely the extent of this questioning of accuracy. We must therefore be content to describe it as existing as a general sense of doubt.

To this statement, there is no direct equivalent that deals with the accuracy of astrometeorology in the work of Theophrastus or Aristotle. What we can do, however, is attempt to understand their potential opinion of it by looking at how it would have fitted

into Peripatetic meteorological theory and thus reverse-engineer an explanation for astrometeorology from arguments made throughout the *Meteorologica.*

Aristotle's scientific treatises are concerned with establishing four types of causes.[95] In modern scholarship, these are generally termed the material/physical, formal, efficient and final. Their remits can be summarised as answering the following questions: 'what is it composed of?', 'what is it?', 'what brought it about?' and 'what is it for?' respectively.[96] In the *Meteorologica,* Aristotle is concerned primarily with the material and formal causes of meteorological phenomena. He summarises the two at *Mete.*1.ii (339a27-32):

> ὥστε τῶν συμβαινόντων περὶ αὐτὸν πῦρ μὲν καὶ γῆν καὶ τὰ συγγενῆ τούτοις ὡς ἐν ὕλης εἴδει τῶν γιγνομένων αἴτια χρὴ νομίζειν … τὸ δ' οὕτως αἴτιον ὅθεν ἡ τῆς κινήσεως ἀρχή, τὴν τῶν ἀεὶ κινουμένων αἰτιατέον δύναμιν.
>
> " So it is necessary to regard fire, earth and the associated elements the material cause of this topic [meteorological phenomena]… and the cause of the source of their motion is the motivating power of their motion."

Thus the material cause of meteorological phenomena are the terrestrial elements; earth, water, air, fire (…πῦρ μὲν καὶ γῆν καὶ τὰ συγγενῆ…). The efficient cause, however, the force actually creating the meteorological phenomena, is the eternal circular movement of the celestial realm.[97] It is, therefore, not surprising to find a link made between celestial movement and the reoccurrence of regular, seasonal weather, as the following example demonstrates:

> κατὰ δὲ τὰς ὥρας τὰς ἐναντίας οἱ ἐναντίοι μάλιστα πνέουσιν, οἷον περὶ ἰσημερίαν τὴν μὲν ἐαρινὴν καικίας καὶ ὅλως τὰ ἐπέκεινα τροπῆς θερινῆς, περὶ δὲ τὴν μετοπωρινὴν λίβες, περὶ δὲ τροπὰς θερινὰς μὲν ζέφυρος, χειμερινὰς δὲ εὖρος.
>
> "Generally, opposite winds blow more in opposite seasons: for instance, at the time of the vernal equinox Caecias and winds from north of the summer sunrise prevail; in the autumn Lips; around the summer solstice Zephyros, and Eurus at the winter."
>
> \- *Mete.* 2.vi (364a4-364b4)

Here, winds that can be typically expected in each season are described. The winds, like many of Aristotle's meteorological phenomena, are heavily influenced by the seasonal

[95] See *Physics* 194b23-35 with Freeland (1991) 49-72 for an introduction to the discussions of this passage.
[96] Summary after Taub (2003) 80.
[97] On this movement, see *De Caelo* 1 and 2.

position of the sun in the eliptic, the heat it provides to the terrestrial spheres and thus the effect it is having on terrestrial exhalations.[98]

Aristotle's theory of exhalations is fundamental to many of his meteorological explanations. As Taub has noted, Aristotle at no point offers a single clear statement describing and explaining exhalations, but instead alludes to them at various points throughout the *Meteorologica*.[99] What he does say, however, is that they are some sort of ejecta which rise up from the earth when it is heated by the sun. One kind, the 'more vaporous' (ἀτμιδωδεστέρα) is produced when the water in and on the earth is heated. The other, the 'more windy' (πνευματωδεστέρα), comes from the heating of the earth itself.[100] It is the various reactions and movements of these exhalations that Aristotle sees as the efficient cause of meteorological phenomena.

The stars are deemed too far away to have a direct heating influence on the exhalations;[101] their relationship to the weather would therefore seem to be a purely temporal one. They are used as the fixed markers to distinguish different periods of time, which were associated with seasonal weather patterns. We can therefore see that Aristotle's understanding of astrometeorology would have been intrinsically linked to the very reason for the weather itself. This strengthens the idea that astrometeorology would have been viewed as a more reliable system of prediction and could thus be presented as such – since the predictions would be directly related to the cause and would be as accurate as the cosmos would allow. Through a discussion of accuracy, then, we have built up a way of explaining astrometeorology through the application of Aristotelian meteorological ideas. It is now important to consider this same issue within the context of weather signs – how were they explained, and did this affect how they are treated in our texts?

Explaining Weather Signs I

Sider and Brunschön believe that full explanations for weather signs existed in the Peripatetic tradition. This is on the basis that Aristotle and Theophrastus are both credited in antiquity with writing texts that appear to deal with weather signs; the Σημεῖα χειμώνων and a Περὶ σημείων respectively. It is unlikely, they argue, citing the *Physiognomica* which is concerned with explaining the signs it contains, that either of

[98] See *Mete*. 362a25-6
[99] Taub (2003) 89.
[100] These descriptions appear at *Mete*. 1.4 (341b6-24). Taub (2003) 88-92 provides a good discussion of the exhalations and their meteorological functions.
[101] As stated at 341a22.

these philosophers would have written texts that did not feature explanations.[102] Because Aelian, at *On Animals* 7.7, states that he "learnt from Aristotle" various signs, Sider and Brunschön believe that that text preserves a lengthy paraphrase from Aristotle's work and suggest that Aelian was one of the authors to strip Aristotle's text of its scientific, explanatory framework.[103] They therefore reject Scholfield's entirely plausible suggestion[104] that Aelian is quoting from the *De Signis*, mistakenly believing it to be by Aristotle, since Aelian's account contains signs not found in the *De Signis*. I, however, am unconvinced by their arguments. We know that the *De Signis* as we have it has been consistently and widely credited to Aristotle since antiquity[105] and, as I have argued earlier, weather sign lists were very fluid in their contents and explicitly allowed for individual additions and alterations. Further to this, in no later texts that discuss how to explain weather signs is even a mention given of earlier Peripatetic explanations, nor do we have evidence of a text that resembles what Sider and Brunschön envisage – weather sign lists as we have them contain only weather signs, no explanations.[106] In Cicero's *De Divinatione*, for example, Marcus explicitly states that many weather signs are not understood.[107] Similarly, Seneca's *Natural Questions* makes no reference to Aristotelian attempts to explain them (despite Seneca's large-scale interaction with Aristotle[108]), and the same is true in the fragments that remain of Plutarch's '*Explanations of Aratus' Weatherlore*'. I am therefore not convinced that a systematic series of explanations of weather signs did ever exist in the way Sider and Brunschön envisage.

Indeed, it would perhaps be surprising to find full explanations for all, given the reputation of meteorological matters as difficult to explain. We saw above how Aristotle contrasted the strict, predictable nature of the heavenly bodies with the general, but by no means guaranteed, cyclicity of meteorological phenomena. He forewarns us of another issue with the study of meteorology at *Mete.*1.i (339a3): [109]

ἐν οἷς τὰ μὲν ἀποροῦμεν, τῶν δὲ ἐφαπτόμεθά τινα τρόπον·

[102] Sider & Brunschön (2007) 4: "…what we have here [in the *De Signis*] is largely the signs, stripped of any philosophical underpinning or scientific framework that Aristotle or Theophrastus would surely have supplied…".
[103] Sider & Brunschön (2007) 11-12.
[104] At Scholfield (1959) 103.
[105] See Cronin (1992) 308-310 and Sider & Brunschön (2007) 40.
[106] This is true right from Aratus, through Pliny the Elder, the Geoponica, and into present day accounts of weather signs.
[107] See p.173 for discussion of this.
[108] On the influence of Aristotle's meteorological theories on Seneca's, see French (1994) 170; 172 and Hine (2010) 5.
[109] For more on Aristotle's difficulty in studying meteorological phenomena, see Taub (2003) 78.

> "Of these phenomena, some we find inexplicable, of others we can grasp something."

There is, then, an assumption underlying Aristotle's meteorological investigations that definite answers may not be possible, and some phenomena are beyond explanation.

It is noteworthy, however, that some of the weather signs featured in the Aristotelian corpus are accompanied by explanations, but not, I would suggest, in any way that would suggest explanations for all the signs once existed. Since explanation of weather signs will be an important recurring theme throughout this thesis, it is important that I detail a number of the Aristotelian weather signs here. I have, in the following passages, made the relevant sections that are the actual explanations bold. The first discusses the significance of comets:

> περὶ δὲ τοῦ πυρώδη τὴν σύστασιν αὐτῶν [comets] εἶναι τεκμήριον χρὴ νομίζειν ὅτι σημαίνουσι γιγνόμενοι πλείους πνεύματα καὶ αὐχμούς· **δῆλον γὰρ ὅτι γίγνονται διὰ τὸ πολλὴν εἶναι τὴν τοιαύτην ἔκκρισιν, ὥστε ξηρότερον ἀναγκαῖον εἶναι τὸν ἀέρα, καὶ διακρίνεσθαι καὶ διαλύεσθαι τὸ διατμίζον ὑγρὸν ὑπὸ τοῦ πλήθους τῆς θερμῆς ἀναθυμιάσεως, ὥστε μὴ συνίστασθαι ῥᾳδίως εἰς ὕδωρ.**
>
> "We may regard as a proof that their [comets'] constitution is fiery the fact that their appearance in large numbers is a sign of coming wind and drought. **For it is clear that they owe their origin to a vast quantity of this kind of exhalation, which by necessity makes the air drier, while, at the same time, the moist evaporation is disintegrated and dissolved by the amount of the hot exhalation, so that it will not readily condense into water."**
>
> - *Mete*. 1.vii (344b19-27)

Here, we are told that comets can be taken as a sign of wind and drought. This is because they are formed by hot, dry exhalations, the presence of which makes the air drier, leading to a lack of condensation of moist air into water and thus, no rainfall. The second sign is a lengthy exposition of haloes,[110] which provides us with a variety of predictions:

> πρῶτον δὲ περὶ τῆς ἅλω τοῦ σχήματος εἴπωμεν, διότι τε κύκλος γίγνεται, καὶ διότι περὶ τὸν ἥλιον ἢ τὴν σελήνην, ὁμοίως δὲ καὶ περί τι τῶν ἄλλων ἄστρων· ὁ γὰρ αὐτὸς ἐπὶ πάντων ἁρμόσει λόγος. **γίγνεται μὲν οὖν ἡ ἀνάαὐτὸς ἐπὶ πάντων ἁρμόσει λόγος. γίγνεται μὲν οὖν ἡ ἀνά κλασις τῆς ὄψεως συνισταμένου τοῦ ἀέρος καὶ τῆς ἀτμίδος εἰς νέφος, ἐὰν ὁμαλὴς καὶ μικρομερὴς συνισταμένη τύχῃ.** διὸ καὶ σημεῖον ἡ μὲν σύστασις [halo] ὕδατός ἐστιν, αἱ μέν- τοι διασπάσεις ἢ μαράνσεις, αὗται μὲν εὐδιῶν, αἱ δὲ διασπάσεις πνεύματος. ἐὰν μὲν γὰρ μήτε καταμαρανθῇ μήτε διασπασθῇ, ἀλλ' ἐαθῇ τὴν φύσιν ἀπολαμβάνειν τὴν αὐτῆς,

[110] A ring around the sun or moon. The Greek word is ἅλως, its Latin equivalent *corona*. Modern meteorologists distinguish between haloes and coronas - see Dunlop (2001) 58; 109 - but the two terms appear to be synonymous in antiquity – on which see McCartney (1928a) 28-29 with n.86 and McCartney (1928b) 34-5 with Böker (1962) 1165-1672.

ὕδατος εἰκότως σημεῖόν ἐστι· **δηλοῖ γὰρ ἤδη γίγνεσθαι τοιαύτην τὴν σύστασιν, ἐξ ἧς τὸ συνεχὲς λαμβᾶ νούσης τῆς πυκνώσεως ἀναγκαῖον εἰς ὕδωρ ἐλθεῖν·** διὸ καὶ μέλαιναι γίγνονται τὴν χρόαν αὗται μάλιστα τῶν ἄλλων. ὅταν δὲ διασπασθῇ, πνεύματος σημεῖον· **ἡ γὰρ διαίρεσις ὑπὸ πνεύματος γέγονεν ἤδη μὲν ὄντος,** οὔπω δὲ παρόντος. σημεῖον δὲ τούτου διότι ἐντεῦθεν γίγνεται ὁ ἄνεμος, ὅθεν ἂν ἡ κυρία γίγνηται διάσπασις. ἀπομαραινομένη δὲ εὐδίας· **εἰ γὰρ μὴ ἔχει πως οὕτως ὁ ἀὴρ ὥστε κρατεῖν τοῦ ἐναπολαμβανομένου θερμοῦ μηδ' ἔρχεσθαι εἰς πύκνωσιν ὑδατώδη, δῆλον ὡς οὔπω ἡ ἀτμὶς ἀποκέκριται τῆς ἀναθυμιάσεως [ἀπὸ] τῆς ξηρᾶς καὶ πυρώδους· τοῦτο δὲ εὐδίας αἴτιον.**

"Let us first deal with the shape of the halo and explain why it is circular and why it appears around the sun or moon or similarly round one of the other stars. For the same explanation will fit all these cases. **The reflection of our vision takes place when the air and vapour are condensed into cloud, if the condensation is uniform and its constituent particles small.** This formation is therefore a sign of rain, while if it is broken it is a sign of wind, if it fades, of fine weather. For if it neither fades nor breaks, but is allowed to reach its full development, it is reasonable to regard it as a sign of rain, **since it shows that a condensation is taking place of the kind, which, if the condensing process continues, will necessarily lead to rain**. And for this reason these haloes are the darkest of all in colour. But when it is broken it is a sign of wind; **for its break up is due to a wind that is already in being but has not yet arrived**. An indication that this is so is that the wind springs from the quarter in which the main break occurs. When it fades it is a sign of fine weather. **For if the air is not yet such as to overcome the heat contained in it and to turn into a watery condensation, it is clear that the vapour has not yet separated from the dry and fiery exhalation; and it is this which causes fine weather**."

- *Mete*. 3.iii (372b12-34)

This passage tells us that haloes are caused by reflections of light within clouds that have uniform condensation and are made up of small particles of water. Observing a halo can therefore be taken to indicate rain, since this comes from clouds. Similarly, if one observes a halo forming, it indicates cloud formation and therefore rain. Haloes are broken up due to wind moving the clouds, so seeing this happen suggests wind is on its way. Seeing a halo fade points to fine weather since it means that air is not condensing, suggesting the presence of dry and fiery exhalations, which cause fine weather.

Of these from the *Meteorologica*, it is important to note, as Taub has done, that the interest appears to lie not with explaining these weather signs, but with how the signs, or indeed the explanations of them, can provide evidence to support his explanations of meteorological phenomena.[111] In the first example, for instance, they are employed as "proof that comets' consistency is fiery" and in the second, the weather signs serve as confirmation for Aristotle's theories on the formation of haloes, as the opening sentences

[111] Taub (2003) 96-8.

of the above passage demonstrates. A third sign comes from the *History of Animals* and discusses cranes:

> Φρόνιμα δὲ πολλὰ καὶ περὶ τὰς γεράνους δοκεῖ συμβαίνειν· ἐκτοπίζουσί τε γὰρ μακράν, **καὶ εἰς ὕψος πέτονται πρὸς τὸ καθορᾶν τὰ πόρρω, καὶ ἐὰν ἴδωσι νέφη καὶ χειμέρια, καταπτᾶσαι ἡσυχάζουσιν.**
>
> "Many examples of intelligence seem to occur in cranes also. For they migrate a long way, and **fly up high to assess the distance, and if they see clouds and storms, they descend and keep quiet**."[112]
>
> - *H.A.*8.X (614b18-21)

This piece of information is presented not as a weather sign *per se*, but as an example of the intelligence of birds.[113] McCartney is surely right, though, to see it as underlain by an existing weather sign,[114] in which watching for descending, quiet cranes indicates an incoming storm. The cranes are therefore credited with performing an inspection of distant cloud formations, and thus making the conscious decision to descend in order to avoid incoming bad weather. The fourth sign is taken from the same text:

> Ἄρχονται δὲ τῆς ὀχείας περὶ τὸν Θαργηλιῶνα μῆνα καὶ τὸν Σκιρροφοριῶνα αἱ πλεῖσται· οὐ μὴν ἀλλ' ἔνιαι καὶ μέχρι τοῦ μετοπώρου κυΐσκονται. Ὅταν δὲ πολλαὶ κύωσι καὶ προσδέχωνται τὴν ὀχείαν, σφόδρα δοκεῖ σημεῖον εἶναι καὶ χειμῶνος καὶ ἐπομβρίας.
>
> "Most cows begin their copulation about the month of Thargelion or Skirrophorion, though some become pregnant as late as autumn. Where large numbers of cows are pregnant and submit to copulation, it it held to be a sure sign of stormy and rainy weather."[115]
>
> - *H.A.*6.XXI (575b15-19)

In this passage, large numbers of cows being pregnant and mating is taken to be a sign of stormy and rainy weather. In contrast to the Aristotelian signs we have seen so far, this is an example of a sign for which no explanation is offered. The final two weather signs come from *Problemata*,[116] book 26:

> Διὰ τί αἱ μὲν καθαραὶ δύσεις εὐδιεινὸν σημεῖον, αἱ δὲ τεταραγμέναι χειμερινόν; **ἢ ὅτι χειμὼν γίνεται συνϊσταμένου καὶ πυκνουμένου τοῦ ἀέρος; ὅταν μὲν οὖν κρατῇ ὁ ἥλιος, διακρίνει καὶ αἰθριάζει αὐτόν, ὅταν δὲ κρατῆται, ἐπινεφῆ ποιεῖ. ἐὰν μὲν οὖν ἰσχυρὰ ᾖ ἡ σύστασις, εὐθὺς ἡμέρας γίνεται χειμών· ἐὰν δὲ**

[112] Translation by Balme (1991).
[113] On animal intelligence in Aristotle, see French (1994) 49.
[114] McCartney (1921a) 90.
[115] Translation by Peck (1970).
[116] As Mayhew (2011) xvi-xvii has argued, the authorship of this text is not firmly known to be Aristotelian. Instead, it is more likely a composite of early Peripatetic writers, of whom Aristotle was one. It can, therefore, give us an indication of Aristotelian ideas.

ἀσθενεστέρα, μὴ παντάπασι δὲ κρατουμένη, τὸ συνιστάμενον ἐξωθεῖται πρὸς τὰς δύσεις. ἐνταῦθα δὲ μένει διὰ τὸ παχύτατον εἶναι τὸν περὶ τὴν γῆν ἀέρα τοῦ χειμῶνος. ταχὺ δὲ συνίσταται καὶ ὁ ἄλλος διὰ τὸ ἔχειν ἀρχὴν καὶ ἔρεισμα, ὃ δέξεται καὶ ἀθροίσει τὸ προσιὸν καθάπερ ὅρθρος· ὥσπερ γὰρ ἐν τροπῇ ἑνὸς ἀντιστάντος καὶ οἱ ἄλλοι μένουσιν, οὕτω καὶ ἐπὶ τοῦ ἀέρος. διὸ ταχὺ καὶ ἐξαίφνης ἐνίοτε γίνεται καὶ ἐπινέφελα. ὅταν οὖν αἱ δύσεις τεταραγμέναι ὦσι, σημεῖόν ἐστιν ἰσχυρὸν ὅτι οὐ κεκράτηκεν ὁ ἥλιος τῆς συστάσεως, πολὺν ἰσχυρὸν ὅτι οὐ κεκράτηκεν ὁ ἥλιος τῆς συστάσεως, πολὺν χρόνον ἐναντιούμενος αὐτῇ, ὥστε εἰκότως ἔστι συστῆναι πλέον. καὶ ἧττον δέ ἐστι φοβερόν, ὅταν προχειμάσαντος ἢ ὅταν ἐξ εὐδίας τοῦτο συμβῇ. ἐκείνως μὲν γὰρ ἔοικεν ὥσπερ ὑπόλειμμά τι εἶναι, οὕτω δὲ ἀρχὴ συστάσεως.

"Why are clear sunsets a sign of fine weather whereas disturbed sunsets are a sign of stormy weather? **Is it because a storm comes when the air condenses and thickens? Now when the sun achieves mastery, it separates the airs out the air, but when it is mastered, it makes the air cloudy. Therefore, if the density is strong, a storm comes as soon as it is day; whereas if it is weaker, but not completely mastered, the condensed part is pushed out toward the sunset. And it remains there because it has a source and support, which will receive and collect what comes to it just like dawn; for just as in a rout when one man resists the other also remain, so also in the case of air. This is why it sometimes quickly and suddenly becomes overcast. Therefore, when the sunsets are disturbed, it is a strong sign that the sun has not mastered the density, though opposing it for a long time, so that (the air) has likely condensed much more.** Now it is less alarming when this happens as a storm is brewing than out of calm weather. For in the former case it would seem to be some remnant of the storm, but in the latter it is the beginning of condensing."[117]

- *Prob.*26.8

Here, a clear sunset is a sign of fine weather and a hazy one a sign of a storm. The former because the sun disperses cloud and stops air condensing, the latter because a confused sunset is not able to do this so air compresses, presumably as the day cools down towards its end, and this causes a storm. As with the signs from the *Meteorologica*, meteorological theories of exhalations are here used to explain the sign.

Our final Aristotelian sign is the following:

Διὰ τί τὰ ἀράχνια τὰ πολλὰ ὅταν φέρηται, πνεύματός ἐστι σημεῖα; **πότερον ὅτι ἐργάζεται ὁ ἀράχνης ἐν ταῖς εὐδίαις, φέρεται δὲ διὰ τὸ ψυχόμενον τὸν ἀέρα σὔνιέναι πρὸς τὴν γῆν, τὸ δὲ ψύχεσθαι ἀρχὴ χειμῶνος**· σημεῖον οὖν ἡ φορὰ τῶν ἀραχνίων. **ἢ ὅτι μετὰ τὰ ὕδατα καὶ τοὺς χειμῶνας γίνεται τῶν ἀραχνίων ἀθρόα ἡ φορά, ἐν ταῖς εὐδίαις ἐργαζομένων, διὰ τὸ ἐν τῷ χειμῶνι μὴ φαίνεσθαι;** δύσριγον γὰρ τόδε. καὶ φερόμενοι ὑπὸ τοῦ πνεύματος πολὺ ἐκπηνίζονται. μετὰ δὲ τὰ ὕδατα εἴωθε πνεύματα γίνεσθαι ὡς τὰ πολλά.

"Why is it that when many spiders' webs blow about it is a sign of wind? **Is it because the spider works in the calm weather, but the webs travel because the air as it cools collect on the ground, and this cooling is the beginning of**

[117] *Problemata* translations by Mayhew (2011).

> **winter?** So the blowing about of the spiders' webs is a sign of winter. **Or is it because after the rain and storm the movement of spiders is considerable, as they work in the calm weather because they do not appear in winter? For this insect cannot bear the cold.** So when they are blown about by the wind they spin a long thread. And it is after rain that winds generally come."
>
> - *Prob.*26.61

This is a particularly interesting treatment of a weather sign. The sign in question is that of spiders' webs moving about being a sign of wind. Here, a single explanation has proved unobtainable. Instead, two possible reasons are provided. The first is that air is cooling and collecting on the ground due to winter beginning. The connection here may be that rain falls more in the winter[118]and winds typically follow rain – as stated at the end of the above 'problem': μετὰ δὲ τὰ ὕδατα εἴωθε πνεύματα γίνεσθαι ὡς τὰ πολλά. The second reason given is unclear and confusing but seems to relate to spiders moving around rapidly after rainfall, with again the connection made between rain and wind that follows. It is noticeable that, in contrast to the crane sign above, the spiders in this sign are not reacting to forthcoming patterns in the weather: they themselves are not sensing that a change is about to take place. No judgement on which explanation is correct is offered.

Aristotle provides, where possible, explanations distinct to individual weather signs. Those signs that can be explained operate for a variety of different reasons. It would seem, however, that not every sign can be easily explained and certain signs may seem to operate due to a number of potential explanations. For those signs for which no explanation is given, it is, of course, not possible to know whether this is because Aristotle had no explanation; because he gives the explanation in some other, now lost, text; or simply because an explanation would add nothing to the text and was thus felt irrelevant. It is striking, however, that for no explanation does Aristotle state that he has already given it elsewhere,[119] and that his explanations of weather signs display nothing in the way of doxographical engagement.[120] Indeed, as I demonstrated in the introduction to this thesis, we can, and are in fact encouraged by texts, to come up with our own weather signs – they need not be developed from any tradition of study. It may be the case, then, that during Aristotle's meteorological investigations, he 'fell upon' potential

[118] See *Meteorologica* 2.iv (360a2-5).
[119] In contrast to, for example, *Meteorologica* 1.iii, where Aristotle tells us that he has dealt with the properties of the 'primary element' elsewhere. There are many other examples of this in Aristotle's work.
[120]In contrast to Aristotle's practice elsewhere. For Aristotle's doxography in the *Meteorologica,* see Taub (2003) 96-8.

explanations of already existing weather signs,[121] and chose to fit these in where relevant, or saw that his theories allowed him to invent new signs. Roger French has noted that small pieces of information that do very little other than interest and illustrate occasionally appear in Aristotle's work and that these are frequently connected with animals.[122] I would suggest therefore that there is nothing in Aristotle's treatment and use of weather signs to suggest that there was any serious interest in them or that he was actively looking to explain them. The only times where the explanations of weather signs are of interest for the purpose of explaining them are three examples from the *Problemata*, two quoted above, and another from 26.23 which discusses shooting stars as a sign of wind. And, in fact, even these signs are discussed not because they are of interest in and of themselves, but because they contain information about the winds, the topic of the entire twenty-sixth book.[123] Having thus looked at the Aristotelian handling of weather signs, we must now broaden our scope to consider other approaches to explanation, beginning with Epicurus.

In the course of his *Letter to Pythocles*, the philosopher Epicurus discussed his views on meteorological matters. Rather like Aristotle, Epicurus too argues that meteorological phenomena are much more difficult to understand than others. He, though, states that this is true of astronomical phenomena also:

> μήτε τὸ ἀδύνατον [καὶ] παραβιάζεσθαι, μήτε ὁμοίαν κατὰ πάντα τὴν θεωρίαν ἔχειν ἢ τοῖς περὶ βίων λόγοις ἢ τοῖς κατὰ τὴν τῶν ἄλλων φυσικῶν προβλημάτων κάθαρσιν·
>
> "We must not try to force an impossible explanation, nor employ a method of inquiry like our reasoning either about the modes of life or with respect to the solution of other physical problems."[124]
>
> - *Epist. Ad Pyth.* 86

Studying meteorology, Epicurus is stating here, is not like investigating ethics or laws of physics, it is a more slippery subject and so a different approach is required. That approach is to accept the possibility of multiple explanations. Since we cannot get close enough to carry out detailed studies, if multiple explanations are available for a particular phenomenon, and all the explanations are in themselves valid, then all explanations

[121] This may be particularly possible if, as French (1994) 86-7 suggests, many of Aristotle's works were written slowly, in parallel. Thus things like weather signs, which cut across his meteorological and zoological works, may naturally have emerged.
[122] French (1994) 49.
[123] The given title is ΟΣΑ ΠΕΡΙ ΤΟΥΣ ΑΝΕΜΟΥΣ, 'Problems connected with the Winds'.
[124] Epicurus translations are, throughout, slightly adapted from Bailey (1926).

should be held to be true.[125] Choosing one explanation over another takes one away from scientific inquires and into the realm of myth. This leads him to make two suggestions for the operation of weather signs:

> ἐπισημασίαι δύνανται γίνεσθαι καὶ κατὰ συγκυρήσεις καιρῶν, καθάπερ ἐν τοῖς ἐμφανέσι παρ᾽ ἡμῖν ζῷοις, καὶ παρ᾽ ἑτεροιώσεις ἀέρος καὶ μεταβολάς· ἀμφότερα γὰρ ταῦτα οὐ μάχεται τοῖς φαινομένοις· ἐπὶ δὲ ποίοις παρὰ τοῦτο ἢ τοῦτο τὸ αἴτιον γίνεται οὐκ ἔστι συνιδεῖν.
>
> "Signs of the weather may occur owing to concurrence with seasons, as happens with animals we can all see on earth, and also through alterations and changes in the atmosphere. For both these are in accordance with phenomena. But under what circumstances the cause is produced by this or that, we cannot perceive."
> - *Epist. Ad Pyth.* 98-99

Here, he distinguishes between two types of weather sign; those that occur due to temporal coincidence (i.e. the time of the year) and those that result from alterations and changes in the atmosphere. Weather signs would seem to firmly belong in Epicurus' group of phenomena of which very close investigations could not be made in order to give a firm single explanation. In fact, the statement at the end of this passage, that it is not possible to distinguish which of these two (τοῦτο ἢ τοῦτο) is true at any given time of a particular sign, a statement unique to his discussion of weather signs, may imply an added sense of uncertainty. Bailey makes a similar observation, noting that Epicurus is "almost excessively cautious here".[126] The focus of the explanation, guided by the closing line, seems to be not on the plethora of potential causes, but on the uncertainty of those that have been provided.

Epicurus does, however, suggest that signs from some animals fall into the first category of those signs that are the result of temporal coincidence. He expands on this idea at *Epist. Ad Pyth.*115:

> Αἱ δ᾽ ἐπισημασίαι αἱ γινόμεναι ἐπί τισι ζῴοις κατὰ συγκύρημα γίνονται τοῦ καιροῦ. οὐ γὰρ τὰ ζῷα ἀνάγκην τινὰ προσφέρεται τοῦ ἀποτελεσθῆναι χειμῶνα, οὐδὲ κάθηταί τις θεία φύσις παρατηροῦσα τὰς τῶν ζῴων τούτων ἐξόδους κἄπειτα τὰς ἐπῖ σημασίας ταύτας ἐπιτελεῖ.
>
> "The signs of the weather which are given by certain animals result from mere coincidence of occasion. For the animals do not exert any compulsion for the winter to come to an end, nor is there some divine nature which sits and watches the outgoings of these animals and then fulfils the signs they give."

[125] See *Epist. Ad Pyth.* 86-7.
[126] Bailey (1926) 162.

Epicurus here argues that animals do not exert an influence on the seasons and nor is there a divine being somewhere that watches for the actions of animals and reacts to their significance as weather signs. Certain animal weather signs, therefore, are due merely to coincidence; they appear with the seasonal changes.

It is important to note that Epicurus, as always in his philosophy, rejects the possibility that weather signs are due to the influence of any divine being. Taub is right, I suspect, to suggest that this may be not only a reminder of his over-arching theories on the role (or, in fact, lack thereof) of gods, but a swipe at the specific idea that some god is providing weather signs for humans.[127] Let us, for example, think back to the passage quoted above from Aratus' *Phaenomena* which directly attributes the appearance of weather signs to the benevolence of Zeus.[128] That is his explanation for weather signs but, crucially, it does appear that even Aratus himself was not entirely convinced. We witnessed him, after all, making excuses for the unreliability and inaccuracies of the weather signs, telling us that we do not understand everything about Zeus' actions, and that weather signs are very much presented at his will. Knowing that they are sent by Zeus is, then, really only half the answer; there are still gaps of understanding to fill. Indeed, I do not think that we are meant to take Aratus' statement as meaning Zeus provides the signs in the way Epicurus imagines the divine explanation to work; we are not to envisage Zeus sat somewhere and actively sending out birds to act as weather signs, or shaping clouds in a particular, significant way. Instead, Zeus established the systems by which weather signs operate. This proposal is consistent with Aratus' portrayal of the gods elsewhere. For example, in the opening proem to Zeus, we are told the following:

> αὐτὸς γὰρ τά γε σήματ' ἐν οὐρανῷ ἐστήριξεν
> ἄστρα διακρίνας, ἐσκέψατο δ' εἰς ἐνιαυτὸν
> ἀστέρας οἵ κε μάλιστα τετυγμένα σημαίνοιεν
> ἀνδράσιν ὡράων...
>
> "For [Zeus] himself fixed the signs in the sky, distinguishing between the constellations, and organised the stars for the year to give the most clearly defined signs of the seasons to men…"
>
> \- *Phae.* 10-13

Here, we are told that Zeus put the constellations in the sky in the manner that we now see them, and made them operate in such a way as to provide information to their observers about the time of year. So, when at line 732, while describing how the risings

[127] Taub (2003) 128.
[128] See p.58 above.

and settings of stars can be used for timing purposes, specifically to estimate the length of night, we are told that 'everywhere the gods give these many predictions to men' (πάντη γὰρ τάγε πολλὰ θεοὶ ἄνδρεσσι λέγουσιν), the meaning is not that the gods are actively rotating the sphere of stars, or moving the constellations, but that the system by which this movement occurs is divine by establishment, as revealed in the proem. This makes me think that we should read Aratus' weather signs in the same manner – not that some god is actively involved with every sign, but that how the signs relate to the weather and therefore why they appear was established by Zeus, and it is these systems and the 'will of Zeus' in this manner, that is inscrutable to men. Thus it would seem that squaring the realities of weather signs with a divine theory is just as difficult as squaring them with a rationalist or physical theory.

In addition to these three engagements with the subject, we have reports that the Stoic philosopher Boëthos[129] made some attempts to understand predictive signs. We find this twice in the ancient evidence. The first is from Geminus' *Isagoge*:

> Ὅθεν καὶ Βόηθος ὁ φιλόσοφος ἐν τῷ τετάρτῳ βιβλίῳ τῆς Ἀράτου ἐξηγήσεως φυσικὰς τὰς αἰτίας ἀποδέδωκε τῶντε πνευμάτων καὶ ὄμβρων, ἐκ τῶν προειρημένων εἰδῶν τὰς προγνώσεις ἀποφαινόμενος.
>
> "Thus also Boëthos the philosopher, in the fourth book of his commentary on Aratus, has described the natural causes of both winds and rains, ἐκ τῶν προειρημένων εἰδῶν τὰς προγνώσεις ἀποφαινόμενος."
>
> - *Isag.*17.48

Boëthos' commentary on Aratus, this passage tells us, contained a discussion of the causes of the winds and rain and ἐκ τῶν προειρημένων εἰδῶν τὰς προγνώσεις ἀποφαινόμενος. Exactly what this final clause means is a matter of some dispute. F.H.Sandbach, in his Loeb edition of Plutarch's *Moralia* which includes the '*Explanations of Aratus' Weatherlore*', appears to think that is means Boëthos spent the full four books of his commentary explaining all the weather signs.[130] James Evans and J. Lennart Berggren , in their translation of the *Isagoge*, render it "[Boëthos] has indicated the prognoses [to be drawn][131] from the aforementioned conditions",[132] suggesting that they believe that Boëthos explained the signs that can be gleaned from wind and rain, which seems to me highly unlikely; signs are generally taken for weather, not from the

[129] Boëthos of Sidon (2nd century BC), Stoic philosopher. See Lehoux (2008) on him generally. For details of his lost commentary see Maass (1898) 324 and Kidd (1997) 46.
[130] Sandbach (1987) 89.
[131] Evans & Berggren's square brackets.
[132] Evans & Berggren (2006) 226.

weather. None of these scholars appear to be aware of the following mention of the same Boëthos in Cicero's *De Divinatione*:

> *Etsi video Boëthum Stoicum esse conatum, qui hactenus aliquid egit, ut earum rationem rerum explicaret, quae in mari caelove fierent. Illa vero cur eveniant, quis probabiliter dixerit?* …[quote from Aratus' weather sign section, featuring signs from birds]
>
> "Yet I see that the Stoic Boëthus has attempted to do so and has succeeded to the extent of explaining the phenomena of sea and sky. But why the following things occur, who can give a plausible explanation?"
>
> - *De Div.*1.vii

Here, Boëthos is credited with attempting to explain weather signs, but manages only those taken from the "sea and sky". He was thus apparently unable to explain, for example, the bird signs that follow this passage. I think, therefore, that the ἐκ τῶν προειρημένων εἰδῶν in the Geminus passage above refers very generally to the type of indicators used by Aratus, which are summarised briefly at *Isagoge* 17.47 and are therefore 'aforementioned'.

This discussion of the explanations given for weather signs has allowed us to observe some very important points. Firstly, we have seen that the causes of weather signs was a topic of interest to philosophers and natural scientists of all persuasions, both rationalist and theist, albeit in quite a small way and typically within the context of other topics. They are part of the discourse on natural history and science, but only when they intersect with other topics. Secondly, however, the given causes differed across the philosophical schools, with what seems like very little agreement. Indeed, the most striking difference between each of the others discussed above is the variety of methodological approaches. Aristotle would have us deal with each sign individually; Epicurus attempts to apply two broad explanatory schemes to all signs; Aratus would seemingly like to have a divine explanation that accounts for everything; and Boëthos appears to have looked for explanations by grouping similar signs together. But no system works; as we have seen, they all fall short in one way or another. This leads us to a third, and perhaps most important conclusion here – that the recurring pattern across the explanation attempts is that weather signs are difficult to understand and hard to explain. This is true of a number of meteorological phenomena more generally, as we have seen Aristotle and Epicurus articulate, but I have attempted here to demonstrate that weather signs did receive some degree of explanatory interest, but that this interest came up short. As we will see later, the reception of these texts and ideas and the continuing struggle to

explain weather signs give us further indication that no methodology was wholly successful in finding full explanations for all signs, and that the reputation of weather signs as troublesome was widely recognised.[133] There is a good chance, I believe, that this difficulty may have compounded the sense of doubt that existed over the accuracy of weather signs and reinforced their depicted position as 'secondary' to astrometeorology.

Indeed, that understanding and explaining how these predicition methods worked was a significant factor in the trust that was placed in them is demonstrated by Geminus. Underlying the entirerity of his book 17 is the premise that if we wish to use a predictive method, we should first understand it. This is part of why the book is devoted to correcting the contemporary explanation of astrometeorology. In that book, as we shall see in more detail later, Geminus says that using weather signs may be preferable to using astrometeorology. His reason for this is as follows:

> αἱ γὰρ ἀπὸ τούτων προγνώσεις μετά τινος φυσικῆς αἰτιας γινόμεναι κατηναγκασμένα ἔουσι τὰ ἀποτελέσματα.
>
> "For the prognoses from these things [weather signs], arising from some natural cause, have results which are inevitable."
>
> - *Isag.* 17.48

Weather signs, this sentence tells us, are preferred by Geminus for two reasons: they have inevitable results, and definable causes. I will shortly show that the views Geminus expresses about weather prediction are probably strikingly different from his contemporaries but, regardless of this, his statement that causes are a major concern to him demonstrates how significant understanding these predictive methods must have been. Afterall, Geminus tells us that he is writing to correct commonly-held opinions, so he must be writing in a way, and using arguments, that he deems convincing enough to do that; we can assume that his discussion of causes would have appealed to a readership.[134]

Weather signs, as we saw from Hesiod's use of natural signs, are a body of knowledge which are thought to have developed, existed and operated entirely independently of the explanations and ideas that were attached to them. They thus provided a common ground of information amongst the various philosophers. I have already stated above that the list form of the weather sign tradition remained remarkably

[133] Discussed in pp.173-189 below.

[134] The same sense of the importance of understanding before prediction comes across in the Hippocratic corpus, particularly *Prognostic* 1.19-23: "It is necessary, therefore, to learn the nature of such diseases, how much they exceed the strength of men's bodies, and to learn how to forecast them." This will be discussed further below, see pp.102-4.

static over thousands of years, and that many weather predictors that exist today have ancient roots. This fact further makes me believe that there was relatively little philosophical engagement with them and certainly not the full-scale studies that Sider and Brunschön imagine. Unlike astrometeorology, which, as we have seen, developed through scientific and philosophical invention, weather signs appear not to have benefitted from this level of technical interest; explanations were having to be reversed-engineered back into existing signs. Similarly, they appear to have occupied, at best, just the fringes of Greek scientific discourse and were primarily used when they could augment or illustrate an argument, and discussed when they could be featured as part of treatment of another topic, as in the case of Aristotle.

Again, a comparison between weather signs and physiognomics proves useful here in highlighting the peculiarities of weather sign discourse. In the opening sections of the Aristotelian *Physiognomica*, theoretical justifications for the operation of physiognomics are laid down (chapter 1, 805a1-19) and previous methods and practicioners are assessed and criticised (805a20-805b27) in a manner typical of Aristotelian doxography. These two processes are absent not only from the *De Signis* but from weather sign lists and discussions elsewhere too.[135]

Whether prognostic signs were deemed in some way not worthy of isolated detailed study, perhaps because they represented a functioning system which could not be expanded upon in a methodical scientific way, or maybe because they had reached a developed, fully operational stage with no scientific input, it is impossible to say. This potential place in ancient science, however, makes me think that the list form, which is demonstrated by the *De Signis* and the *Phaenomena*, and is the most common way of finding discussions of weather signs, is actually the form in which these signs were dealt with. They were collected together, occasionally added to or edited, but fundamentally remained as simply a long list of signs.

To return to the explanation of astrometeorology, by the time Geminus' *Isagoge* was written, there appears to have been two competing explanations. The first is along the lines of the Aristotelian one I suggested above,[136] giving credence to my reconstruction, in which the sun (and to a lesser extent the moon) is responsible for the weather changes, and the stars relate to these changes in a purely temporal way:

[135] It is perhaps also worth noting here that 'prognosticator'/'weather predictor' (or similar terms) do not, as far as I have been able to find, appear in ancient lists of *technai*.
[136] Indeed, Geminus appears heavily indebted to Aristotelian cosmological and meteorological theory. See, for example, 17.2 for mention of the theory of exhalations, with Evans & Berggren (2006) 217, n.1, or 17.15 for a reference to *aither* as an element.

> ἀπὸ μὲν γὰρ ἡλίου καὶ σελήνης διικνεῖται ἡ δύναμις ἐπὶ τὴν γῆν κατὰ τὰς μεταβάσεις αὐτῶν καὶ μειζόνων καὶ ἐλαττόνων…
>
> Καὶ ὥσπερ ὁ πυρσὸς οὐκ αὐτός ἐστι παραίτιος τῆς πολεμικῆς περιστάσεως, ἀλλὰ σημεῖόν ἐστι πολεμικοῦ καιροῦ, τὸν αὐτὸν τρόπον καὶ αἱ τῶν ἄστρων ἐπιτολαὶ οὐκ αὐταὶ παραίτιοί εἰσι τῶν περὶ τὸν ἀέρα μεταβολῶν, ἀλλὰ σημεῖα ἔκκεινται τῶν τοιούτων περιστάσεων.
>
> "Now, the power from the sun and moon does reach as far as the Earth, and, in accordance with their motion, is either greater or smaller…
>
> And just as the beacon is itself not a cause of war, but is a sign of a season of war, in the same way the risings of the stars are not themselves causes of the changes in the air, but stand as signs of such conditions"
>
> - *Isag.* 17.17; 17.11

As the second statement above suggests, however, there is also the theory that the stars are directly influencing the weather in a very 'astrological' way; the weather changes not just at the same time as the rising and setting of the stars, but <u>because</u> of the rising and settings.[137] Although there are evidently two popular explanations for astrometeorology presented here, what is important is that both of them are complete – they both offer systems for fully understanding astrometeorology. The weather sign explanations could not achieve this.

As well as astrometeorology, Geminus does discuss weather signs in his *Isagoge* and, somewhat surprisingly, appears to be quite in favour of them. However, I suggest that we must take his discussion cautiously.

Weather Signs in Geminus' Isagoge

Chapter 17 of Geminus' *Isagoge* is devoted to a discussion of weather prediction. In it, he aims to demonstrate using "mathematical and physical opinion" (17.1) that astrometeorology works not because the stars influence the weather, but because weather patterns are broadly cyclic and the movement of the stars is itself repetitious. They therefore perform the role of weather indicators; just as a signal beacon does not cause war, but merely indicates it, so the stars are related to the weather. As Lehoux has recently reaffirmed, it is important to note that it is this explanatory aspect of astrometeorology that Geminus argues against, and not, as became a mistaken trend in the

[137] This theory is attacked at length at *Isagoge* 17.26-45.

scholarship, the practice of predicting through astrometeorology.[138] The non-causal relationship he describes leads him to conclude that one would be better off using terrestrial weather signs:

> Ὅθεν βελτίοσιν ἄν τις σημείοις χρήσαιτο τοῖς ὑπὸ τῆς φύσεως ἡμῖν διδομένοις…
>
> "Thus one could make use of the better signs, which are given to us by nature…"
> - *Isag.* 17.46

We could easily take this statement as evidence for the fact that in the late Hellenistic period, there was an increased belief in the validity of weather signs over astrometeorology. However, this extrapolation from Geminus' text would, I think, be far too extreme. To understand the implications of Geminus' statement, we need to first understand what he is trying to do in chapter 17 as a whole.

By arguing for a non-causal relationship between the stars and the weather, Geminus suggests to us that he is attempting to correct the current thinking on stellar causality widely held by laymen:

> Ὁ περὶ ἐπισημασιῶν λόγος παρὰ μὲν τοῖς ἰδιώταις ἀλλοίαν ἔχει διάληψιν ὡς ἐπὶ τῶν ἄστρων ἐπιτολαῖς καὶ δύσεσι τῶν περὶ τὸν ἀέρα μεταβολῶν γινομένων. Ὁ δὲ μαθηματικὸς καὶ φυσικὸς ἑτέραν ἔχει δόξαν.
>
> "The understanding concerning weather prediction held amongst laymen is the false one that the rising and setting of the stars causes a change in the air. But mathematical and physical opinion has a different idea."
> - *Isag.* 17.1

This statement tells us that the idea of stellar causality was a common one held by many people at the time Geminus was writing. Those holding this opinion, Geminus' ἰδιώται, are evidently people who do not have detailed mathematical or scientific, and perhaps specifically astronomical, training; their knowledge is juxtaposed against scientific knowledge in the μὲν… δὲ… construction that operates across the two sentences. They must, however, be adequately well educated to be literate since chapter 17 deals explicitly with parapegmata, which are either literary or inscriptional. The use of parapegmata by these people must have been sufficiently widespread and significant to warrant this detailed study by Geminus; using a parapegma to forecast the weather would therefore seem to be the norm.

It is with this in mind that we must read his comments on terrestrial weather signs. The fact that Geminus has to argue that weather signs would be the better method, and

[138] Lehoux (2007) 158.

the contrast that this establishes with astrometeorology, appears to suggest that they are not being extensively used to predict the weather. By proposing the use of weather signs, then, Geminus is actually swimming against the tide of general opinion on the matter. This is also certainly true when looked at in the context of the works that have come before Geminus' *Isagoge* and are analysed here in this chapter. In particular, Geminus cites the accuracy of predictions from weather signs, and the extent to which they are understood as reasons for their use. We have seen, though, that other authors prior to Geminus (and we will see that many authors after him too) deem weather signs to be less regular, potentially less accurate and less scientifically grounded than astrometeorology. Geminus' opinion would seem to be his opinion alone, or at least not the prevailing understanding of the relationship between the two methods.

In view of this, we should now consider some crucially important questions: what role were weather signs meant to be playing in the predominantly astrometeorological weather prediction of the 4th century BC onward? Why are they framed in practical terms?

Why Weather Signs?

As I stated above, modern scholars have been content to describe the function of weather signs simply as 'predicting the weather'. If my model for their usage, as depicted in the *De Signis* and *Phaenomena*, is correct, however, we can start to think of their role as more nuanced and specific; in their relation to astrometeorology within lists like that of the *De Signis*, there is the possibility that they were constructed in order to serve a very particular predictive purpose. It is important firstly, though, to deal with a potential opponent to my theories on the operation, and relative nature, of weather signs and in doing so, reflect on the argument I have put forward about why astrometeorology became shown as the central system. I will here approach ancient weather prediction as it has thus far been approached in scholarship, with the assumption that weather signs are used in a way resembling the 'Hesiodic' observation I described previously in this chapter and that they can function as an independent system. I will attempt here to reconstruct how they are constructed to operate alongside astrometeorology. To do this, we need to establish some of the history of astrometeorology and astrometeorological parapegmata.[139]

I have already stated that a significant point in the development of parapegmata was the time-reckoning and astrometeorological investigations done by Euctemon and

[139] For a fuller picture of this, see Lehoux (2007) 22-6.

similar scientists in the mid-5th century BC. It is not clear whether their work resulted in parapegmata, or simply the production of a series of astrometeorological observations. The earliest occurrence we have of an actual astrometeorological parapegma, with the weather associated to the date in a systematic fashion, is the early 3rd century BC; this is P.Hibeh 27, a literary parapegma from Egypt.[140] The Geminus parapegma probably predates the late 2nd century BC and the earliest inscriptional astrometeorological parapegma is the fragmentary Greek inscription known as Miletus II,[141] which dates from 89/8 BC.

There is no evidence from which to identify exactly when the move from 'astrometeorology' to 'astometeorological parapegma' happened. This piece of information would have actually better enabled us to understand how the weather signs fitted into astrometeorology during the period from the mid-5th century to the early 3rd century BC but in its absence, we must instead hypothesise two slightly differing situations.

As I have noted above, it is from the early 3rd century BC that our first astrometeorological parapegma dates. Having a written parapegma with astronomical and meteorological observations referenced against a calendar of some description (in P.Hibeh 27 the Egyptian calendar) has substantial implications for the observation of phenomena. Lehoux has argued that as parapegmata began to appear in this form, the need to observe actual stellar phases was removed, since it was the date, or peg, that was observed.[142] This is an important premise to keep in mind for the two potential situations I will now detail.

In this first scenario, we shall assume that astrometeorological parapegmata first appeared in the mid-fifth century; perhaps that Euctemon did actually produce a parapegma. Following Lehoux's model, observation of stellar phenomena is thus reduced and perhaps even entirely removed. What role, in this situation, are weather signs playing? Let us look again at the Geminus parapegma as an example of early Greek astrometeorological parapegmata. Quoted here in its entirety is the Leo entry:

> τὸν δέ Λεοντα διαπορεύεται ὁ ἥλιοσ ἐν ἡμέραις λα'.
>
> ἐν μὲν οὖν τῇ α' ἡμέρᾳ Εὐκτήμονι Κύων μὲν ἐκφανής, **πνῖγος** δὲ ἐπιγίνεται· **ἐπισημαίνει**.

[140] Text and translation available at Lehoux (2007) 217-223; discussion at Lehoux (2007) 153-4.
[141] A.ii. in Lehoux (2007); see p.154-7 for details and images.
[142] Lehoux (2007) 55-69. He concludes on p.69 that "although the theoretical signs associated with predictions are the astronomical phenomena, the practical signs – the things actually looked at by the astrologer in working out his predictions – turn out to be texts, tables and instruments: pegs, not stars".

ἐν δὲ τῇ ε' Εὐδόξῳ Ἀετὸς ἑῷος δύνει.
ἐν δὲ τῇ ι' ἡμέρᾳ Εὐδόξῳ Στέφανος δύνει.
ἐν δὲ τῇ ιβ' Καλλίππῳ Λέων μέσος ἀνατέλλων **πνίγη μάλιστα** ποιεῖ.
ἐν δὲ τῇ ιδ' Εὐκτήμονι **πνίγη μάλιστα** γίνεται.
ἐν δὲ τῇ ις' ἡμέρᾳ Εὐδόξῳ **ἐπισημαίνει.**
ἐν δὲ τῇ ιζ' Εὐκτήμονι Λύρα δύεται· καὶ ἔτι **ὗει**· καὶ **ἐτησίαι** παύονται· καὶ Ἵππος ἐπιτέλλει.
ἐν δὲ τῇ ιη' Εὐδόξῳ Δελφὶς ἑῷος δύνει. Δοσιθέῳ Προτρῦγητὴρ ἀκρόνυχος ἐπιτέλλει.
ἐν δὲ τῇ κβ' Εὐδόξῳ Λύρα ἑῷος δύνει· **ἐπισημαίνει.**
ἐν δὲ τῇ κθ' Εὐδόξῳ **ἐπισημαίνει**. Καλλίππῳ Παρθένος ἐπιτέλλει· **ἐπισημαίνει.**

"The sun passes through Leo in 31 days.

On the 1st day, according to Euctemon, the Dog is visible; **strong heat; change in the weather.**
On the 5th, according to Eudoxus, the Eagle sets in the morning.
On the 10th day, according to Eudoxus, the Crown sets.
On the 12th, according to Callipus, Leo, rising to the middle, produces **strong heat** to the greatest degree.
On the 14th, according to Euctemon, there is **strong heat** to the greatest degree.
On the 16th day, according to Eudoxus, there is a **change in the weather**.
On the 17th, according to Euctemon, the Lyre sets; **it rains; the Etesian winds** cease; the Horse rises in the evening.
On the 18th, according to Eudoxus, the Dolphin sets in the morning. According to Dositheus, Vindemiatrix[143] rises acronychally.
On the 22nd, according to Eudoxus, the Lyre sets in the morning; **change in weather.**
On the 29th, according to Eudoxus, there is a **change in the weather**. According to Callipus, Virgo rises; **change in the weather**.

- 212.14-25; 214.1-6.

Of the 31 days it takes the sun to pass through the sign of Leo, this parapegma gives meteorological entries for just seven days, the meteorological terminology emboldened in the above quotation. What of the other 23; how do we know what the weather will be like then? Presumably, we have to fill these gaps with other predictive methods, namely, weather signs. So too the problematic 'ἐπισημαίνει' – the weather changes, but to what? Perhaps weather signs here provide the required suggestion.

We can now adopt an alternative hypothetical situation, that astrometeorological parapegmata appeared later than the mid-5th century- thus some time after the developments in astrometeorology- and that astrometeorology therefore still required a degree of stellar observation. Weather signs in this situation might not only plug gaps in the predictions as above, but would also provide potential predictions when stellar observation was not possible; on, for example, cloudy nights.

[143] Following the rendering of Lehoux (2007) 233.

In both these scenarios, weather signs would potentially fill gaps in astrometeorology. But we have a problem. As I have discussed above, one would struggle to use weather signs in this way firstly because there is a strong chance that one would not be in the right place at the right time to successfully observe them, and secondly because one would have to constantly be on the look-out for an impractical array and volume of potential signs. Those, as I have already shown, are basic problems with the sign-to-text model of observation. Further to this, Greek meteorology does not reveal an interest in having a 'full' system of forecasting – a system that would allow predictions to be made on every day and would attempt to predict every change in the weather – that this could potentially provide. As the Aristotle passage defining meteorology quoted above demonstrates, meteorological phenomena were viewed as being somewhat irregular and, we can therefore presume, more difficult to predict. The formation of such a system would thus seem beyond expectation. Similarly, despite the fact that astrometeorology fell far short of offering predictions for every day of the year, in no extant parapegmata, literary or inscriptional, is there a clause that states 'for missing days, supplement this parapegma with another predictive method'; thus this model of weather signs fitting 'around' astrometeorology and filling in gaps would not seem to be the correct one to follow. Recognising that completeness of prediction is not a priority in Greek weather forecasting, and that, as I have argued throughout, regularity is, means that my suggestion for the operation of weather signs looks all the more plausible. I therefore suggest that rather than a full system, the aim of Greek weather prediction was to forecast as accurately as possible the few important changes in weather that could be predicted; the focus, as I argued above, was on the predictable, cyclic patterns. This would account for the interest in regularity, which allows securely-timed predictions to be made, and the potential favouring of a system that is deemed to be more accurate, as I discussed above.

But if the full system hypothesis seems at odds with the apparent priorities of Greek prediction, what were the weather signs of *De Signis* actually thought to be doing? Taking weather signs as operating as I have suggested can get us to a possible answer.

Let us imagine that an ancient Athenian has consulted astrometeorology and discovered that on this particular day, rain is expected. Astrometeorology cannot be any more precise than this. Our imagined Athenian can now spend the day, if it is not already raining and he needs the additional information, being on the look-out for weather signs that would indicate to him that rain was approaching. This gives him the option to potentially get a more specific time-frame on the predicted weather conditions. As we have seen above, though, this is only potentially an option as the system is too irregular

and perhaps inaccurate for its predictions to be guaranteed. We can thus see how rather than fitting around astrometeorology, as the 'full' system would have it, weather signs could fit in to astrometeorology.

It is possible to provide a modern parallel to demonstrate this. Published each day in many national newspapers is a weather forecast. This is typically a very general overview of the predominant weather type for that day. So, for example, the forecast from the *Daily Telegraph* for Monday 18th July 2011 is as follows:

> "GENERAL SITUATION: A trough of low pressure will continue to bring unsettled weather across the United Kingdom today. Showers will continue across most areas with cloudy skies."

This is followed by a regional forecast, which again focuses on the predominant weather type, but adds a little more detail. The entry for Scotland is given here:

> "Largely cloudy today with scattered showers. A moderate northwesterly wind. Max 14-18C (57-64F). Broken cloud tonight with a shower or two. Min 8-12C (46-54F)."

In addition to this, a longer-range forecast, covering the following few days, is given:

> "OUTLOOK: Sunny intervals across the United Kingdom on Tuesday with scattered showers. Mainly cloudy across southern England on Wednesday with a couple of showers."

We can think of this as being like a parapegma; it provides a general overview of what weather to expect on certain days. Like the parapegma's "according to Dositheus, it is stormy", these modern predictions feature a forecast summing up the day. For many people, this general indication of the state of the weather is sufficient. What is apparent in these forecasts, however, is that, like the ancient astrometeorological predictions, they are very imprecise. It says "scattered showers", but some people may need to know exactly when it is likely the rain. For this information one would turn to, for example, an online source that could provide more detailed predictions for the day, or a forecast that could offer more precise, perhaps even occupationally-specific, data, such as the shipping forecast.[144] This usage is similar to that which I would suggest the weather signs are pictured as having. This analogy is, of course, a crude one – not least because the modern general and precise predictions are made by the same method – but I think it does go some way towards representing the potential operation of the ancient system in our texts and demonstrating that different 'tiers' of weather prediction can operate simultaneously.

[144] For a study of the history, science and cultural significance of the shipping forecast, see Jefferson (2011).

The relationship between the two predictive methods when using this structure of lists has thus become more fully defined. Astrometeorology appears to offer broad, long-range forecasts, and terrestrial weather signs add a level of specificity to those predictions. This model has, however, has resulted in a problem; how do we account for the seasonal predictions made by some weather signs?

The final two paragraphs (56 and 57) of the *De Signis* are devoted to signs "said to be signs for whole seasons or for <smaller> parts" (λέγεται δὲ καὶ τοιάδε σημεῖα ὅλων τε τῶν ἐνιαυτῶν γίνεσθαι καὶ τῶν μορίων· *DS* .6).[145] With the inclusion of this section, the neat organisation of the text into groups according to weather type is destroyed. The fact that this section seems to be awkwardly attached to the main body of information has been recognised in scholarship. Sider and Brunschön, for example, go so far as to characterise it as an addendum.[146] Reference is not made to them in the introduction to the *De Signis* (*DS.*1), which mentions just signs of rain, winds, storms and fair weather. Aratus also groups his seasonal signs together; lines 1044-63 list some general seasonal signs, 1064-93 give signs for predicting the weather in the coming winter and 1094-1103 features summer signs. Within each of these groupings, a mixture of weather types is predicted. It seems, then, that these longer-range predictions were viewed as being in some way different from the rest of the signs. I have argued throughout this chapter that regularity and predictability of appearance fundamentally underlies how these weather sign lists were constructed. Even when a treatment seems different, such as with the Manger and sun and moon in the *Phaenomena*, this is actually a manifestation of the same idea. This does not, however, appear to apply to these seasonal signs. The sources of the signs are varied, including plants, animals and birds, and many do not have an element indicating when they should be looked out for. Should we, then, completely reject the model I have suggested in this chapter, which is so reliant on timing one's observations correctly? I do not think so.

The fact that the seasonal signs are largely grouped together at the end of the weather sign sections, and somewhat awkwardly in the case of the *De Signis*, is, I think, quite revealing. We must remember that it is highly likely that the structures of the these weather sign lists are constructions of collections of weather signs, and evidence,

[145] It is important to note that I am not here discussing seasonal signs of the type listed at, for example, *DS.* 44, which use current weather conditions to predict those for the future e.g. "if autumn is unusally fair, spring will be cold". With using these signs, there is no great problem, as they can be used with astrometeorology in broadly the same way as the other signs, since they use a knowledge of the current weather as their starting point. These signs are also integrated into the main body of the text, suggesting they are conceptually different from those grouped at the end.
[146] Sider and Brunschön (2007) 35.

discussed above, would seem to imply that they are rearrangements of 'raw data' that was potentially organised, differently. I believe it possible, therefore, that these seasonal signs, which would have played an important role in 'Hesiodic' prediction, were found to not fit easily into the method of observing weather signs that the *De Signis* and the *Phaenomena* represent. They still had, though, an intrinsic value as weather predictors and for this reason, they were grouped together, in a manner different from other signs, and included in the weather sign passages. The awkwardness of their appearance and the fact that they seem not to embody the same general meteorological focus as the other signs, that of the importance of availability of observation, is therefore due to the simple fact that they are inherently different and do not operate easily alongside the other signs; the apparent shift in emphasis seen in the texts is a real reflection of the nature of the signs themselves.

We have therefore seen how, in these Greek texts, the two predictive methods are presented as being related in practical terms and have made suggestions for why this particular relationship developed. It is necessary now to change focus slightly and discuss how weather prediction is depicted in Greek literature and consider what it was typically associated with. I aim to argue here that in the Greek periods covered by this chapter, both astrometeorology and weather signs could equally be associated with rural life and activities. This is an immensely important premise to establish here since I will argue later in this thesis that this perception of the methods changes in the Roman world and that this impacts on the Roman view of weather signs and thus how the predictive methods were compared to one another. Let us begin by returning to Hesiod.

4. Depicting Weather Prediction

Hesiod

It almost need not be stated that Hesiod's *Works and Day*s is a poem concerned with rural life. In the *Theogony*, Hesiod paints himself as originally being a humble shepherd (*Th.*22-3), and it is this agricultural expert that we imagine chastising the feckless Perses in the *Works and Days.* As I have argued above, this poem presents a body of agricultural knowledge within which divisions are virtually non-existent. Weather prediction was thus just part of this collection of knowledge which enabled the agricultural world to operate and was therefore included in the descriptions in Hesiod's poem. Agriculture, however, is not the only frame of reference in which weather prediction is placed. In addition to the lengthy descriptions of, and advice concerning, various pieces of farm

work (esp. *Op.*383-617; 765-821), discussed above, the *Works and Days* features a famous extended description of the perils of seafaring[147] (*Op.*618-694), including this description of the influence of the weather:

> **ἤματα πεντήκοντα μετὰ τροπὰς ἠελίοιο,**
> ἐς τέλος ἐλθόντος θέρεος καματώδεος ὥρης,
> ὡραῖος πέλεται θνητοῖς πλόος· οὔτε κε νῆα
> καυάξαις οὔτ᾽ ἄνδρας ἀποφθείσειε θάλασσα,
> εἰ δὴ μὴ πρόφρων γε Ποσειδάων ἐνοσίχθων
> ἢ Ζεὺς ἀθανάτων βασιλεὺς ἐθέλῃσιν ὀλέσσαι·
> ἐν τοῖς γὰρ τέλος ἐστὶν ὁμῶς ἀγαθῶν τε κακῶν τε.
> **τῆμος δ᾽ εὐκρινέες τ᾽ αὖραι καὶ πόντος ἀπήμων·**
> εὔκηλος τότε νῆα θοὴν ἀνέμοισι πιθήσας
> ἑλκέμεν ἐς πόντον φόρτον τ᾽ ἐς πάντα τίθεσθαι.
> σπεύδειν δ᾽ ὅττι τάχιστα πάλιν οἶκόνδε νέεσθαι·
> μηδὲ μένειν **οἶνόν τε νέον** καὶ ὀπωρινὸν ὄμβρον
> **καὶ χειμῶν᾽ ἐπιόντα Νότοιό τε δεινὰς ἀήτας,**
> **ὅστ᾽ ὤρινε θάλασσαν ὁμαρτήσας Διὸς ὄμβρῳ**
> **πολλῷ ὀπωρινῷ, χαλεπὸν δέ τε πόντον ἔθηκεν.**
> ἄλλος δ᾽ εἰαρινὸς πέλεται πλόος ἀνθρώποισιν·
> **ἦμος δὴ τὸ πρῶτον, ὅσον τ᾽ ἐπιβᾶσα κορώνη**
> **ἴχνος ἐποίησεν, τόσσον πέταλ᾽ ἀνδρὶ φανείῃ**
> **ἐν κράδῃ ἀκροτάτῃ,** τότε δ᾽ ἄμβατός ἐστι θάλασσα·
>
> "**For fifty days after the solstice**, when summer comes to an end, the toilsome season, sailing is in good season for men; You will not wreck your boat nor will the sea drown men – unless Poseidon the earth-shaker or Zeus, the king of the immortals, wish to kill them, for in them is all good and evil. **That is when breezes are easy to distinguish and the sea is painless.** Then, confidently trusting your quick ship to the winds, drag it to the sea and fill it with all your cargo. Hurry to go back home as quickly as possible, not waiting for **new wine** and autumn rain **and approaching winter and terrible gales of Notos, which stirs up the sea along with Zeus' heavy late-summer rain, and makes the sea difficult**. Spring is the other time for sailing for men; then, **when the tracks left by a crow are thought by men to be as big as the leaves at the top of a fig-tree**, the sea is crossable."

Here, the times that are good and bad to sail are, like the agricultural tasks discussed above, linked to the weather and thus a basic calendar-like system. So, sailing is good for men for 50 days after the summer solstice (663), because the winds are easy to distinguish, and the sea is calm (670). But wait until the grapes are ready to pick (the οἶνόν τε νέον of line 674), in September,[148] and face the terrible blasts of Notus, a rough sea, and heavy rain (675-7). Better sailing then returns when spring comes back around, and the 'leaves at the top of the fig-tree are as big as the footprint a crow leaves' (679-

[147] On seafaring in Hesiod, see Rosen (1990).
[148] West (1978) *ad loc.*

81). We can thus see that the information provided for sailing is in much the same form as it is for agriculture; a mixture of natural signs and astronomical indicators signifying seasons and therefore weather changes, which determine which activities can be done when. By using these examples of farming and sailing, Hesiod not only identifies groups of people who are especially affected by the weather, but also establishes the paradigms for describing and depicting the rural world, the influence of which we will see both in this following section and throughout this thesis more generally.

While this has allowed us to see the early roots of Greek rural depictions, which we will need to recall at various point, Hesiod's work is, as I have shown above, too early to allow comparisons to be made between the two predictive methods. Some later texts, after the divide between the two methods was made, must now therefore be considered.

Hellenistic Poetry I: Theocritus and Apollonius

Theocritus *Idyll* 22, *The Hymn to the Dioscuri*, celebrates the brothers Castor and Polydeuces as the guardians of sailors. It opens, in hymnic form, with a description of a boat which has come into trouble at sea and found itself in the middle of a storm. Its sails are ripped and its crew near to death. Then, miraculously, the winds calm, the sea returns to its tranquil state and the clouds are parted to reveal the night sky. During this sketch, we see both methods of weather prediction described. Firstly, we are told that the ship set out "defying the constellations that set and rise in the heavens" (νηῶν θ᾽ αἳ δύνοντα καὶ οὐρανὸν ἐξανύοντα / ἄστρα βιαζόμεναι... 22.8-9), representing astrometeorology. As both Gow[149] and Sens[150] have shown, the verb βιάζω here indicates a willing disregard. Theocritus therefore suggests that the sailors know what the stars mean, they just consciously choose to ignore them. When the storm calms, we see a mention of a weather sign:

> ...νεφέλαι δὲ διέδραμον ἄλλυδις ἄλλαι·
> ἐκ δ᾽ ἄρκτοι τ᾽ ἐφάνησαν, ὄνων τ᾽ ἀνὰ μέσσον ἀμαυρὴ
> φάτνη σημαίνοισα τὰ πρὸς πλόον εὔδια πάντα.
>
> "…the clouds parted; the Bears were seen, and the shining Manger, between the Asses, signalled all was fair sailing."
>
> - 22.20-22

Here, as the storm calms, the Bears (ἄρκτοι) become noticeable and the Manger between the Asses can be dimly seen. Weather lore associated with the visibility of the Manger is

[149] Gow (1952) 386.
[150] Sens (1997) 83.

well attested in antiquity,[151] and, as its inclusion in the *De Signis* and in the weather signs section of the *Phaenomena* indicates, belongs firmly to the 'weather sign' category.[152] In this poem, then, Theocritus links sailing not just with the weather generally, but with weather prediction in particular. Both methods of prediction are shown to be effective and applicable when sailing and his sailors understand them both. In doing so, I would suggest, Theocritus calls upon and reflects not only the Hesiodic paradigm, but also similar patterns elsewhere in Hellenistic literature,[153] discussed below, which connects a 'sailor-character' with predictive knowledge of the weather.

We find the same connections made in Apollonius' *Argonautica*. While the crew of the Argo are waiting to leave the land of the Doliones, prevented from doing so by bad weather, one of the lookouts, Mopsos, notices a halcyon, and uses this to predict the weather:

> ἡ δ' ἄρ' ὑπὲρ ξανθοῖο καρήατος Αἰσονίδαο
> πωτᾶτ' ἀλκυονίς, λιγυρῇ ὀπὶ θεσπίζουσα
> λῆξιν ὀρινομένων ἀνέμων· συνέηκε δὲ Μόψος
> ἀκταίης ὄρνιθος ἐναίσιμον ὅσσαν ἀκούσας.
>
> "A halcyon flew above the blond head of the son of Aison, and with a cry foretold the end of the blowing winds. Hearing it, Mopsos understood the fortuitous meaning of the shore-bird."
>
> - *Argon.* 1.1084-1087.

Mopsos here interprets the appearance and voice of the halcyon as indicating that the winds will soon die down, though I will later show that this weather sign turns out to be far more complicated than it first seems.[154] But weather prediction in the *Argonautica* is not restricted to weather signs alone. When the journey of the sons of Phrixos, who will come to join the Arognauts' expedition, is described, we are presented with an example of astrometeorology:

> καὶ δὴ ἔσαν νήσοιο μάλα σχεδὸν ἤματι κείνῳ.
> Ζεὺς δ' ἀνέμου βορέαο μένος κίνησεν ἀῆναι,
> ὕδατι σημαίνων διερὴν ὁδὸν Ἀρκτούροιο

[151] See *D.S.*22; *Phaenomena* 888-908; Pliny *NH* 18.353
[152] The visibility of the Bears is noted here due to their importance to marine navigation; see Sens (1997) 91 for parallels, including *Phaenomena* 26-7 and 36-44. On the potential of a direct influential link between this *Idyll* and the *Phaenomena* see Sens (1994) 66-9 and (1997) 92.
[153] The connection between this *Idyll* and Apollonius' *Arognautica* is hotly debated. Some see Theocritus influencing Apollonius, others the reverse. Sens (1997) 24-36 with Bulloch (2010) 177 cite the main works in what is, like similar debates elsewhere, an unsolvable question.
[154] See pp.105-6 below.

> "On that day they had been very close to the island. Zeus stirred up the blast of the North wind, and with rain signalled the watery passage of Arktouros."
> - *Argon.* 2.1097-9

Here, the setting of the constellation Arcturus is associated with the appearance of wind and rain. This is a common association in the ancient world, appearing as it does at *Phaenomena* 744-7, in the prologue to Plautus' *Rudens* (69-70, where its violence when setting is noted specifically), and at Pliny *NH* 18.310.

The sailors are not depicted here as the direct observers of the constellation but this does not prevent us, as readers, from making the connection between sailing and the prediction of the weather through astrometeorology. In fact, the whole situation of the sailor, the storm, and the constellation being presented together like this serves to reinforce our impression that astrometeorology would have a role in sailing. Indeed, this would probably have been the expectation to a Hellenistic readership too, since Aratus' *Phaenomena* [155] presents us with exactly the same nexus of connections: sailors, a storm, and the constellation Arcturus:

> καὶ μέν τις καὶ νηῒ πολυκλύστου χειμῶνος
> ἐφράσατ' ἢ δεινοῦ μεμνημένος Ἀρκτούροιο
> ἠέ τεων ἄλλων...
>
> "Also someone on a ship can notice signs of a heavily-heaving storm by paying attention to either terrible Arcturus or some other stars…"
> - *Phae.* 744-6.

It is often noted that the *Arognautica* is poem that interacts with sources and modes of writing beyond straightforward epic verse.[156] It is therefore not surprising to see the sailors in the *Arognautica* linked with knowledge of what was possibly near-contemporary astronomical information. In the passage from Apollonius, the setting of Arcturus is said to signify wind and rain. It is possible that this connection between Arcturus and the weather is the result of the period of astronomical and astrometeorological development in the fifth and fouth century BC. In Hesiod's *Works*

[155] There are other instances of what appears to be shared knowledge/themes/motifs across the poems. See, for example, Hunter (1993) 31-2 with n.91 on the possibility that the death of Mopsos in the *Argonautica* is in some way correcting Aratus'description of the 'kneeling man' constellation.

[156] See, for example, Bulloch (1985) 588, who points to the prominence of "geography, ethnography, anthropology and comparative relgion"; Clauss (2000) 13-15 on Apollonius on Empedocles; Morrison (2007) 273-280 on Apollonius' narrator as 'scholar', providing "scientific, ethnographical and particularly aetiological information" (273). On ethnography in the *Argonautica*, see Hunter (1993) 94-5 and Morrison (2007) 274. On aetiology see, initially, Köhnken (2010) 136-7. For Apollonius' engagement with non-epic sources on a linguistic level, see Redondo (2000). On the lack of helpfulness of distinguishing 'science' and 'literature' in the Hellenistic poetry more generally, see Goldhill (1991) 327. Searches have not revealed any substantial discussions of Apollonius' use of 'scientific' topics, such as astronomy, currently in publication.

and Days, Arcturus is referred to only as a chronological marker (*Op.*566 and 610), and is not directly associated with the weather. We have seen that Aratus employs Arcturus as a weather constellation, and the Geminus parapegma similarly features the following entries in the Scorpio section:

> Ἐν δὲ τῇ εᾗ Εὐκτήμονι Ἀρκτοῦρος ἑσπέριος δύεται· καὶ ἄνεμοι μεγάλοι πνέουσιν.
> Ἐν δὲ τῇ ηῇ Εὐδόξῳ Ἀρκτοῦρος ἀκρόνυχος δύνει· καὶ ἐπισημαίνει· καὶ ἄνεμος πνεῖ.
>
> "On the 5th day, according to Euctemon Arcturus sets in the evening. Great winds blow.
> On the 8th day, according to Eudoxus, Arturus sets at nightfall. There is change in the weather and winds blow."
>
> - 218.19-22

Both Euctemon and Eudoxus, then, are cited as sources for the date of the setting of Arcturus and its relation to unsettled weather. This makes it entirely possible that the developments of the fifth century produced this connection between Arcturus and the weather; perhaps it was even an innovation by Euctemon himself. Apollonius' sailors are thus connected with an element of astrometeorology which can be thought of as if not a relatively recent informational advancement, then at least in line with contemporary thought on astrometeorology, as its appearance in the Geminus parapegma demonstrates. This is a similarly recognisable feature of Apollonius' writing, in which the distant mythic past is woven with, underlain, and informed by the present creating, in Clauss' words a "diachronic narrative".[157] We will shortly revisit the significance of using contemporary knowledge, and consider its relevance to Aratus' *Phaenomena*, to which we now turn.

Hellenistic Poetry II: Aratus

The *Phaenomena* certainly appears to bill itself as a poem about sailing and agriculture. The proem features a number of references to these activities:

> ἐκ Διὸς ἀρχώμεσθα, τὸν οὐδέποτ' ἄνδρες ἐῶμεν
> ἄρρητον. μεσταὶ δὲ Διὸς πᾶσαι μὲν ἀγυιαί,
> πᾶσαι δ' ἀνθρώπων ἀγοραί, **μεστὴ δὲ θάλασσα**
> **καὶ λιμένες**· πάντη δὲ Διὸς κεχρήμεθα πάντες.
> τοῦ γὰρ καὶ γένος εἰμέν. ὁ δ' ἤπιος ἀνθρώποισι

[157] Clauss (2002) 12. This issue is explored in more detail throughout Clauss (2002). More recently, Mori (2008) has demonstrated how previous poetic models and old mythical stories are fused with contemporary political events in the *Argonautica*.

δεξιὰ σημαίνει, **λαοὺς δ' ἐπὶ ἔργον ἐγείρει**
μιμνήσκων βιότοιο· λέγει δ' ὅτε βῶλος ἀρίστη
βουσί τε καὶ μακέλῃσι, λέγει δ' ὅτε δεξιαὶ ὧραι
καὶ φυτὰ γυρῶσαι καὶ σπέρματα πάντα βαλέσθαι.
αὐτὸς γὰρ τά γε σήματ' ἐν οὐρανῷ ἐστήριξεν,
ἄστρα διακρίνας, ἐσκέψατο δ' εἰς ἐνιαυτὸν
ἀστέρας **οἵ κε μάλιστα τετυγμένα σημαίνοιεν**
ἀνδράσιν ὡράων, ὄφρ' ἔμπεδα πάντα φύωνται.
τῷ μιν ἀεὶ πρῶτόν τε καὶ ὕστατον ἱλάσκονται.

"From Zeus let us begin, whom we men never leave unspoken. Filled with Zeus are all the streets, and all of men's assembly places, **filled is the sea and the ports**. All the time we rely on Zeus. For we are his children, and he benevolently gives useful signs to men, and **spurs the people to work, reminding them of their livelihood. He says when the soil is best for oxen and mattocks; he says when the seasons are right for planting plants and sowing all seeds**. For he himself fixed the signs in the sky, distinguishing between the constellations, and organised the stars for the year to **give the most clearly defined signs of the seasons to men, so all will surely grow**. So men always praise him first and last."
- *Phae.* 1-14

Here we are told that the constellations and signs organised by Zeus for mankind provide information for ploughing, sowing, planting and growing. One would be forgiven, therefore, for expecting this practical knowledge to be the focus of the poem itself. In reality, these topics occupy a relatively small amount of the text. As evidence for the fact that the *Phaenomena* is not designed to teach sailors and farmers,[158] Peter Bing has observed that the number of lines discussing seafaring and farming make up "meager totals".[159] Indeed, when one reads the text, these topics do not leap out as the key points of information. It would appear, therefore, that we could not really categorise the *Phaenomena* as an agricultural or occupationally-focussed poem, as the proem would perhaps have us believe. Instead, the instances of the explicit rural framing of the information appear as a series of isolated pockets of reference. Each of these references is summarised below:

Line References	Seafaring or Agriculture?	Details/ Description	Astrometeorology or Weather Sign?
37-39	Seafaring	Greeks use Helice to guide ships, Phoenicians use Cynosura.	N/A

[158] A now largely out-dated view put forward by, amongst others, Bernd Effe (1977) 41-3; attacked primarily by Bing (1994) 100 and Hutchinson (1988) 224-5, with n.17.
[159] Bing (1994) 100 cites 66 verses on seafaring, and 24 on farming. I think his definition of 'farming', however, appears to be a little narrow. He ignores, for example, references to goatherding and shepherding. I would therefore add vv.1044-6, 1094-1100, 1105-1110 and 1113-21 to his 'farming' list, making a new farming total of 46.

152-155	Seafaring	When the Sun comes into conjunction with the Lion, Etesian winds blow and ships no longer need to be under oars.	Astrometeorology
158-9	Seafaring	The Kids often look down on storm-tossed men at sea.	Astrometeorology
265-267	Agriculture	Pleiades mark the beginnings of summer, winter, and the time for ploughing.	N/A
287-302	Seafaring	When Water-pourer rises, open waters are rough. When Sun meets with Capricorn, southerlies blow and weather is cold.	Astrometeorology
408-430	Seafaring	The Altar can signify a stormy sea or sometimes, a helpful southerly wind.	Astrometeorology
729-731	Seafaring	Sailors can use Orion to predict the length of the night.	N/A
742	Agriculture	The seasonal signs are well established and do not require enumeration here.	N/A
744-748	Seafaring	Arcturus can indicate a storm to sailors.	Astrometeorology
758-768	Seafaring	If one wishes to sail, one should spend time learning the signs of storms.	N/A
933-936	Seafaring	Sailors use lightning to predict rain.	Weather Sign
1044-1046	Agriculture	Crofters watch trees and plants to estimate the seasons.	Weather Sign
1051-1063	Agriculture	How the ploughing year is divided up, according to the fruiting of the mastic and the flowering of the stalk of the squill.	Weather Sign
1075-1081	Agriculture	The coming of winter, indicated by the appearance of cranes, is good for the punctual farmer, but no so for the unpunctual one.	Weather Sign
1094-1100	Agriculture	Mainland farmer is distressed by the appearance of flocks of island birds, since this indicates a drought. The goatherd is pleased by the same sign.	Weather Sign
1105-1110	Agriculture	Shepherds use running sheep to foretell storms.	Weather Sign

1113-1121	Agriculture	Ploughmen and herdsmen predict storms from cattle.	Weather Sign

From this table of references, we can see that Aratus takes Hesiod's paradigms and uses them to establish rurality in his own poem.[160] The practical concerns of the proem and rural references in the table reveal that Aratus is using the characters of the sailor and the farmer to construct a rural fiction within the *Phaenomena*. Invoking Hesiod in this way not only lends to the *Phaenomena* a sense of generic pedigree and tradition, but also allows it to create the impression of being a poem about rural life, like the *Works and Days.*

As with the Apollonius and Theocritus examples above, in the *Phaenomena* both methods of weather prediction are used by the rural practitioners; neither of the methods is excluded. Unlike the previous examples, however, it is possible here to see some degree of division between the methods. A broad separation can be seen between the two professions, with all but one of the weather signs associated with the agricultural side, and astrometeorology employed by the sailors alone. Taking our lead from the analysis of Arcturus in the *Argonautica* above, it is worth here briefly looking at the history of the meteorological significance of the stars mentioned in the above table from the *Phaenomena*.

Unfortunately, due to lack of evidence, it is only possible to look at a couple of these examples in any detail. Specifically, none of the constellations in the above table are featured in Hesiod's *Works and Days* with a meteorological significance attached to them and the Altar and the Water Pourer do not appear in any extant contemporary or near-contemporary Greek parapegmata; Acturus has been discussed above, signifying a storm in the *Phaenomena* as it does in the *Argonautica*. We are left, then, with Sun's convergance with Leo signifying the beginning of the blowing of the Etesian winds, its convergance with Capricorn denoting cold weather with southerlies, and the significance of the Kids. Beginning with the Etesian winds, we can turn again to the Geminus parapegma. In this text, the Etesian winds are described as beginning on the 27th day of the Sun's passage through Cancer:

> Ἐν δὲ τ κζῃ Εὐκτήμονι Κύων ἐπιτέλλει. Εὐδόξῳ Κύων ἑῷος ἐπιτέλλει· καὶ τὰς ἑπομένας ἡμέρας νε ἐτησίαι πνέουσιν· αἱ δὲ ε αἱ πρῶται πρόδρομοι καλοῦνται.

[160] See Fakas (2001) 100-48 for a study of this.

> "On the 27th day, according to Euctemon, the Dog rises. According to Eudoxus, the Dog rises in the morning and the Etesian winds blow for the next 55 days. the first 5 days are called the 'prodromoi'."
>
> - 212.4-7

The apparent discrepancy between Aratus' account and that of the Geminus parapegma can actually be rectified fairly straightforwardly. We are told in this parapegma entry that the winds of the first five days of the Etesian winds are called the Prodromoi. It would thus seem that Eudoxus groups the Prodromoi in with the Etesian winds. Others, however, do not. In Aristotle's *Meteorologica*, the Etesian winds and the Prodromoi appear to be referred to as separate groups of winds:

> διὸ περὶ Ὡρίωνος ἀνατολὴν μάλιστα γίγνεται νηνεμία, καὶ μέχρι **τῶν ἐτησίων καὶ προδρόμων**.
>
> "From the rising of Orion to the coming of the Etesian winds and the prodromoi it is generally calm."
>
> - *Mete.*2.5 (361b23-4)

If we take them to be separate groups of winds, as Aristotle does, the Etesian winds proper must begin five days after the start of the Prodromoi. Counting five days from the 27th day of the Sun's path through Cancer (which takes a total of 31 days), we get to the 1st day of Leo. Aratus must therefore be working to the same premise as Aristotle, and not, if the Geminus parapegma is to be believed, Eudoxus.[161]

The Sun's passing into Capricorn reveals similar evidence. It is described in the Geminus parapegma as follows:

> Ἐν μὲν οὖν τῇ α ἡμέρᾳ Εὐκτήμονι τροπαὶ χειμεριναί· ἐπισημαίνει. Καλλίππῳ Τοξότης λήγει ἀνατέλλων· τροπαὶ χειμεριναί· χειμαίνει.
>
> "On the 1st day, according to Euctemon, the winter solstice. Change in the weather. According to Callipus, Sagittarius finishes rising; the winter solstice; stormy."
>
> - 222.21-3

There is little agreement here between Aratus and the Geminus parapegma. Where Aratus has cold weather and southerly winds, the Geminus parapegma has stormy weather. Aratus' astrometeorological information is thus evidently coming from somewhere other than the sources cited in the Geminus parapegma. It is therefore virtually impossible to accurately correlate the attachment of meteorological significance to the Aratean

[161] This is perhaps surprising given Aratus' supposed reliance on Eudoxus for his astronomical information, on which see Kidd (1997) 14-18.

astrometeorological constellation with a definite time period or source. We can, however, make a broad suggestion. We saw above how Apollonius' Arcturus appeared to be a post-Hesiodic innovation that was still considered correct at the composition of the Geminus parapegma. We can, of course, make the same claim about Arcturus in the *Phaenomena*. Similarly, the Kids in the *Phaenomena* are associated with stormy weather. This is, as I have already stated, not found in the *Works and Days*, but features in the Geminus parapegma on the 3rd day of Libra; Ἐν δὲ τῇ γῃ Εὐκτήμονι Ἔριφοι ἐπιτέλλουσιν ἑσπέριοι· χειμαίνει. It therefore seems quite reasonable, I think, to suggest that Aratus' sailors too are credited with up-to-date astrometeorological knowledge, far beyond that demonstrated by Hesiod. That some of the astrometeorological information in the *Phaenomena* may not appear to have antecedents or be attested to contemporaneously elsewhere may well be evidence for the fact that meteorological opinion was not always united, as we have seen in the instance of the Etesian winds and Prodromoi, and has been demonstrated through differences in astrometeorology discussed earlier in this chapter; Aratus' information may be up-to-date but just differing in some details to what has survived down to us now.

This desire to credit the sailors with knowledge of accepted current patterns in astrometeorology may help us to explain the apparent divide between seafaring and agriculture in the *Phaenomena*. It appears that there was a branch of astronomical writing that focussed specifically on nautical astronomy. Examples of this genre of writing are now completely lost to us, but scientists such as Thales and Cleostratus are credited with writing within it.[162] It is possible that this genre incorporated aspects of astrometeorology, and that Aratus' linking of astrometeorology with sailing is a reflection of this genre.[163]

Despite the division present in the *Phaenomena*, it is still true that both methods of weather prediction are associated with rural pursuits; weather signs and astrometeorology both have a role to play in the rural world, it is just within that rural world that a division is potentially observable. The connection between weather prediction and rurality, though, seems perhaps to even stronger than this suggests. It is noticeable that of the seventeen passages that establish the rural theme of the *Phaenomena*, twelve concern weather prediction in some way. This is, of course, unsurprising for the second half of the poem, which focuses on prediction, but even in the astronomical part of the poem, five out of the eight passages discuss prediction. It would

[162] See Erren (1967) 198; Wilamowitz (1924) 201. For ancient nautical astronomy more generally see Cotter (1986) 7-16; Taub (2011).
[163] A suggestion also made by Pendergraft (1982) 76.

seem, then, that one way of establishing or evoking rurality in the Greek world is by featuring weather prediction. Presumably because rural activities are so affected by the weather, weather prediction became inherently associated with them. We will, below, see that this use of weather knowledge as part of rural characterisation developed and took on a different significance when deployed by Roman authors.

This section has enabled us to see how weather prediction was used as part of the practical rural landscape depicted by Greek authors. Both methods of prediction are related to rural pursuits, which are not described pejoratively, but in fact can be seen as the applied side of fairly recent developments in astronomical thought, while still making use of Hesiod's ancient paradigms. We have also seen, however, a potential divide within the depicted rural world, with, in the *Phaenomena* at least, seafaring making more use of astrometeorology than of weather signs, which seem to have been more associated with agriculture.

5. Conclusion

This first part of this thesis set out to describe and explain the changes that took place in Greek thought on weather prediction. We have seen that the development of astronomy as an intellectual discipline profoundly affected how passing time was measured and introduced a division in discussions of weather prediction, which previously used natural signs and astronomical indicators almost interchangeably. After that division, astrometeorology, I have suggested, became the 'primary' method of weather prediction, with weather sign lists being constructed in accordance with those predictions that could be made by astrometeorology. Both methods, though, are treated in such a manner as to suggest that they are viewed as reasonable predictive approaches; weather signs just achieve that status with more hesitancy and doubt attached to them, and by operating in a way that ensures that their prediction is not the only one.

The 'text-to-sign' method that I have advocated here is a new reading of the *De Signis* and has allowed me to challenge the growing scholarly trend which reads this text as approaching weather signs in a completely impractical way, and has reinforced my introductory claim that up until now, weather signs have been approached in a manner that is too focussed on considering them solely in isolation. It also means that I can make a suggestion for the way in which the two halves of the *Phaenomena* are designed to sit together. It has long been an issue with Aratus' poem that the connection between the astronomical first section, and the second, weather sign section has not been entirely

clear. Philosophical unity has been advocated,[164] as has unity through dis-unity on poetic/generic grounds,[165] but a 'scientific' connection has thus far been lacking;[166] what was the connection between astronomy and weather signs? I have now suggested how the second half of the poem is related to the first, since I have argued that the weather signs were constructed in such a way as to be underlain by a body of astronomical knowledge, both time-reckoning and astrometeorological.

I have argued that the *Phaenomena* and the *De Signis* share a broadly common structure to their weather sign list, and that this standardised structure was acknowledged by Geminus. This structure, I have suggested, is based on the regularity and reliability of the appearance of certain types of signs, with the most regular, typically those from the sun, moon, and stars, being placed first in these lists. In doing so, I have offered at least part of an explanation for the structure of Aratus' weather sign list, which has previously been considered a problem area.

For the relationship between astrometeorology and weather signs that I have described here, in which astrometeorology provides 'main' predictions, and weather signs 'supplementary' ones, I have suggested a number of potential causes. In particular, I highlighted first the issue of regularity, and argued that the strict regular risings and settings of the stars made them inevitable favourites for making predictions, and in turn, the very irregular and unpredictable nature of weather signs is often picked up by texts discussing them as a potential issue for their use. I have also suggested that the accuracy of weather signs often comes into question and that such an issue does not seem to impact on astrometeorology. Finally, I drew attention to explanation, and the fact that weather signs were viewed as difficult to explain, or even unexplainable. Certain groups of signs (in particular those from the sky and sea) do appear to have had explanations, but the others (and especially those from animals and birds) appear to have been somewhat troublesome. Regarding astrometeorology, while it did have two competing explanations, both were explanations that accounted for the entire system and left no gaps in the reason for its operation. While weather signs appear to have been considered an entirely possible way to predict the weather, it does seems that as early as the 4th century BC, doubts were being levelled against them, and astrometeorology was viewed as an overall more trustworthy method of prediction.

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[164] For example by Gee (2000) 66-91, who sees unity in the poem by means of Stoicism.
[165] Hutchinson (1988) 215-216, for example, sees the two 'halves' of the *Phaenomena* as very consciously different to reflect their different topics. Fakas (2001) 76-8 sees this sense of division as a generic trope, mirroring the structure of Hesiod's *Works and Days*.
[166] Hutchinson (1988) 216 argues that "nor do positive explanations [for the bipartite structure] in terms of thought seem very satisfying".

In the very final section, I discussed how a selection of Greek authors depicts rural characters by having these characters demonstrate their knowledge of the weather and weather prediction. I demonstrated that such characters are credited with knowledge of both astrometeorology (indeed, up-to-date astrometeorology at that) and weather signs, and are shown employing both methods. This not only further reinforces my argument that it was possible to present both methods as practical, but also set an important context for comparison with Roman material later in the thesis.

Indeed, it is now to the relationship between the Greek and Roman understanding of weather signs that we can now turn to, by considering how weather signs were integrated into Roman intellectual discourse, and how influential Greek texts were in this process.

Part 2: Greek Weather Signs in Rome

The previous chapter on Greek sources allowed us to see two very important developments in the history of the weather sign: firstly, the creation of a division between weather signs and astrometeorology as distinct predictive methods; and secondly, the emergence of astrometeorology as the dominant method. This short chapter will focus on how weather signs were integrated into Roman culture as a topic suited to intellectual study and versification. In particular, I will argue that in the 1st century BC, Roman authors began serious consideration of weather signs, making use of Greek works from, primarily, the 3rd century BC. I will suggest that when looking at weather signs and how they operated, the Romans noted many similarities with their formalised system of divination. As a result, weather signs were frequently compared to divine portents and the two were, at times, even collapsed into one another. This was not, however, a simple one way process. I will go on to suggest that Greek weather sign lists may have, in turn, influenced how Romans constructed lists of portents which were taken from traditional annalistic records.

Regardless of whether studies of weather signs existed in earlier Roman or Italian rural traditions, our evidence of their reception within Roman intellectual and poetic discourse begins, like many other facets of Greek culture, in and around the 1st century BC.[1] As we shall see, Aratus looms large in this reception and appears to have been the main source of weather signs for Roman authors (both as a literary topic, and as an actual prediction technique), but while much has been written on specific points of literary contact between that poet and various Latin poets and writers, the nature of the presence of weather signs in Rome and the process by which they were assimilated into Roman thought has not been considered in detail as a topic in its own right.

Those who have discussed instances of weather signs in Roman writing from the 1st century BC, for instance scholars on Vergil's *Georgics*, take the view that their presence and depiction in such texts is the result of a straightforward and relatively uncomplicated relationship between the texts and cultures. Eugene McCartney summed up this view in 1921 by stating:

[1] There are many studies of Greek influence in Rome during this period. Rawson (1985) remains the standard work. However, there are also studies that stress the same approach as I do, that of Roman reception of Greek material, rather than slavish transmission. Hunter (2006) is a fine example of this, as is Feeney (1998), especially pp.6-11. On this process of 'cultural dialogue' more generally, see Wallace-Hadrill (2008).

"It is impossible to separate the weather lore of the Greeks and Romans. The Latin poets seem to be following blindly a Greek literary tradition. Vergil is clearly under obligation to Aratus, and Aratus versifies the *De Signis* of Theophrastus, who in turn is indebted to Aristotle. Pliny, too, copied Greek sources".[2]

Similarly, but more recently than this, Richard Thomas in his commentary on the *Georgics* discusses the weather sign passage as a piece of Vergilian adaptation of Aratus. Thomas' introduction to the weather signs thus features comments like "the influence of Hesiod gives way to that of Aratus" and "roughly speaking, V[ergil] has reversed the order of his model [*Phaenomena*]". Such statements, which are typical of the approach taken by Vergilian scholars to this section of the *Georgics,*[3] reveal that not only is the process of Roman adoption of weather signs as an intellectual topic taken to be a straight forward one, but that the primary scholarly concern with this passage is with how the Aratean has become Vergilian, and the literary and artistic changes made by various texts between them. As a result, such passages are often studied in isolation, and have not been looked at within a wider context of weather signs as an intellectual topic more generally or of weather signs as a piece of cultural assimilation. My aim in this section is therefore to ask the broader question not of how a specific author alters a specific model, but how Greek weather signs became Roman. By doing this, I hope to show that weather signs did indeed undergo a process of assimilation that was distinctly Roman in its nature.

It is thus important to stress here that divination formed a central part of Roman Republican religion and politics. Cicero tells us that the Roman senate made use of three distinct groups of diviners: the augurs, a board of priests of sacred rites (*Quindecimviri sacris fundis*)[4], both of which were official state diviners, and the *haruspices*.[5] Of these, the first and third are of particular interest here as they are involved with the interpretation of portents.

The augurs[6] were, according to tradition, instituted into Roman governance at the very beginning of Roman history, and is often linked to Romulus himself, who was reportedly a skilled augur, and established their use in the goverance of Rome.[7] Their primary duty was concerned with ensuring practices associated with the *auspica* were

[2] McCartney (1921b) 100.
[3] The same thing can be seen being done in Gillespie (1938) 43-58 and Jermyn (1951a) and (1951b).
[4] The board of priests were responsible for the Sibylline books, the collection of Greek oracular pronouncements. See *De Div.* 1.4 for Cicero's history of their use.
[5] These three groups of state diviners are described at *De Div.* 1.3-4. See Wardle (2006) 2-3 for discussion of the division of these groups, and who comprised them.
[6] For a full study of the role of the augurs, see Linderski (1986).
[7] See *De Div.* 1.3 with Rasmussen (2003) 149 for discussion.

conducted correctly. Typically involving the observation of birds within a specific area,[8] though also including thunder, lightning and sometimes animals, the *auspicia* were portents through which the gods would express their approval or disapproval of actions. [9] Public processes such as elections and military campaigns would warrant the consultation of the augurs.

The *haruspices* were members of the Etruscan elite, who were called upon when the interpretation of specific portents was required. In particular, the *harsupices* seem to have been particularly connected with *prodigia*, unusual events (such as eclipses, plagues, earthquakes, flames in the sky, showers of stones etc.[10]) that were reported to the senate and *exta*, the entrails of animals dedicated to the gods which could be 'read' for specific markings or variations.[11] Again, the interpretation of these phenomena was used at times of critical political decisions, such as the inauguration of magistrates, elections and before military engagements.

We can thus see that the use of divination, and portents in particular, was closely woven into Roman culture, and this was assumed to have been the case since the founding of the city. Indeed, as Rasmussen has demonstrated, divination was an important way in which Romans connection with the past, defined themselves in the present, and looked forward to the future.[12] It appears to have been viewed as proudly Roman process, and fundamental to the continued success of Rome.

1. Predictions and Portents 1: Function and Appearance

It is noticeable that this practice of divining by birds and other phenomena has a number of similarities to the operation of weather signs: a natural signifier is observed (birds and meteorological phenomena featuring prominently), and a prediction or judgment is made on the basis of its outcome. This similarity was not missed by Romans in the 1st century BC who, I believe, partially conflated weather signs with their own practice of divination through portents as a way of integrating them into Roman thought. It is also possible that the quasi-formalised structure of weather sign lists we saw emerge from

[8] On augural *templa*, see Linderski (1986) *passim* and Beck (1994), especially 100-1.
[9] A description of *auspicia* and the processes for their interpretation are given by Cicero at *De Div.* 1.25-32 and 2.71-2. For detailed discussion, see Rasmussen (2003) 149- 168.
[10] Rasmussen has collected together a substantial number of examples of these; see Rasmussen's *prodigia* table at (2003) 53-116.
[11] For descriptions, see, *inter alia, De Div.* 1.16, 2.28-32. See Rasmussen (2003) 117-148 and Wardle (2006) 141-2 for modern discussions.
[12] Rasmussen (2003) 241- 256.

Greek sources in the previous chapter came to influence the structure of lists of portents. To see this as a uniquely Roman process, however, we must first discuss the relationship between weather prediction and omens as viewed in the Greek world.

To establish a conceptual and methodological backbone to this discussion, we can begin with a quote from the Hellenistic Stoic philosopher Chrysippus:

> χρὴ δ' εἰδέναι ὅτι τὸ τὰ μέλλοντα προγιγνώσκειν οὐ πάντως θεῖόν ἐστι…καὶ ἰατροὶ γοῦν ἀπὸ ἰατρικῆς προγιγνώσκουσί τινα…οὕτω δὲ καὶ κυβερνῆται… προγιγνώσκουσιν ἐπισημασίας καὶ ἀνέμων σφοδρότητας καὶ τροπὰς περὶ τὸ περιέχον ἔκ τινος πείρας καὶ τηρήσεως καὶ οὐ δήπου παρὰ τοῦτο θείους τις ἂν αὐτοὺς εἶναι φήσειε...
>
> "It is necessary to note that the prediction of the future is not always divine…doctors, on account of medical knowledge, make predictions…and captains too…predict changes, approaching winds, and atmospheric alterations from their experience and vigilance and would certainly not on this account be called gods…"
>
> - Fragment 742[13]

This Chrysippus passage establishes two very important points. Firstly, that there is a conceptualised divide between predictions of the future which are in some way divine, and those that are made on the basis on knowledge, which I will, for ease, call 'technical predictions'. So the doctors, making predictions about patients and diseases from their medical knowledge, ἀπὸ ἰατρικῆς, and sailors, knowing how to forecast the weather on account of their experience and observations, ἔκ τινος πείρας καὶ τηρήσεως, are seen as separate from divine predictions, those that involve, for example, consulting oracles, or interpreting the flights of birds as indicators of the will of the gods. Such a divide has, as we will see, been noted in modern scholarship on ancient medicine, but has not been discussed in the context of weather prediction.[14] Secondly, it provides us with a statement directly emphasising the similarities between medical prediction and meteorological prediction. I intend to exploit this similarity here and use medical texts to think about meteorological ones. This is not a new methodology since Lehoux has seen parallels between terminology use in weather prediction and that employed in the later medical writings of Galen and used such texts to comment on parapegmata.[15] I will here argue that the divide between divine and technical predictions evident in the

[13] Numbering from *Stoicorum veterum fragmenta,* Arnim (1903-1924).
[14] David Sider (2005) 165, however, notes that there appears to have been a division between 'scientific' prediction, and that which is 'more religious', though he does this with a notable absence of ancient evidence.
[15] Lehoux (2004) 83-4.

Chrysippus fragment above can be witnessed elsewhere, especially in the medical texts of the Hippocratic corpus, but also in meteorological writing.

The difference between a doctor and a diviner is brought out clearly in the Hippocratic corpus. In *Prorrhetikon II*, the author begins by describing rumours of miraculous predictions made by doctors, before rejecting them as acts of divination, the type of which he will not practice: Ἐγὼ δὲ τοιαῦτα μὲν οὐ μαντεύσομαι, 'I will not prophesy such things' he states, in a simple, clear dismissal (*Prorrh.*2.2.1). *On Regimen in Acute Diseases* features a similarly black-and-white attack on divination, warning that some circumstances can make medicine look like divination, and that this is not helpful for the reputation of medicine:

> καίτοι διαβολήν γε ἔχει ὅλη ἡ τέχνη πρὸς τῶν δημοτέων μεγάλην, ὡς μηδὲ δοκέειν ὅλως ἰητρικὴν εἶναι· ἔν γε τοῖσιν ὀξέσι τῶν νουσημάτων τοσόνδε διοίσουσιν ἀλλήλων οἱ χειρωνάκται, ὥστε ἃ ὁ ἕτερος προσφέρει ἡγεύμενος ἄριστα εἶναι, ταῦτα νομίζειν ἤδη τὸν ἕτερον κακὰ εἶναι· καὶ σχεδὸν ἂν κατά γε τὸ τοιόνδε τὴν τέχνην φαῖεν ὡμοιῶσθαι τῇ μαντικῇ, ὅτι οἱ μάντιες τὸν αὐτὸν ὄρνιθα, εἰ μὲν ἀριστερὸς εἴη, ἀγαθὸν νομίζουσιν εἶναι, εἰ δὲ δεξιὸς, κακόν· καὶ ἐν ἱεροσκοπίῃ τὰ τοιάδε εὕροι τις ἂν ἄλλα ἐπ' ἄλλοισιν· ἀλλ' ἔνιοι τῶν μαντίων τἀναντία τουτέων.
>
> "Yet the art [medicine] as a whole has a very bad name among laymen, such that there is thought to be no art of medicine at all. Accordingly, since among practitioners there will prove to be so much difference of opinion about acute diseases that the remedies which one physician gives in the belief that they are the best are considered by a second to be bad, laymen are likely to object to such that their art resembles divination; for diviners too think that the same bird, which they hold to be a happy omen on the left, is an unlucky one when on the right, while other diviners maintain the opposite."[16]
>
> \- *Acut.* 3

Divination in this passage is portrayed as the imprecise antithesis of medicine, the interpretation of signs for which is entirely down to an individual's opinion; if patients were to view medicine as being like divination, then they will presume that it does not require specialist knowledge and skill; as Lloyd states, "there was a risk of the doctor being assimilated to the soothsayer, a risk some Hippocratic writers try to guard against".[17] So what exactly is it about technical medical prediction that makes it different from that of divination?

As Edelstein has rightly described, ancient medical prognosis is a semiotic process;[18] it relies on the observation of signs, which, depending on the patient's age

[16] Potter's (1988) translation.
[17] Lloyd (1987) 42.
[18] Edelstein (1967) 70.

and sex, give an indication of the likely course of the disease, and thus health of the patient.[19] The quotation given from *Prorrhetikon II* above continues, making it clear that these signs, and their interpretation, are what mark medical predictions as technical, rather than divine:

> ἐγὼ δὲ τοιαῦτα μὲν οὐ μαντεύσομαι, σημεῖα δὲ γράφω οἷσι χρὴ τεκμαίρεσθαι τούς τε ὑγιέας ἐσομένους τῶν ἀνθρώπων καὶ τοὺς ἀποθανουμένους, τούς τε ἐν ὀλίγῳ χρόνῳ ἢ ἐν πολλῷ ὑγιέας ἐσομένους ἢ ἀπολουμένους·
>
> "I will not prophesy such things, but will record the signs from which one must decide which people will get better and which will die, and which will get better or die in a long time or a short time."[20]
>
> - *Prorrh.*2.2.1-5

The contrast between divination and medical prediction is thus cast in terms of method. Medical prediction is made with clinical judgement, based on the evidence in front of the physician; "I will note the signs", the author states, and make a judgement based on an understanding of those signs. Divine prediction would seem not to employ such methods.

Indeed, understanding and knowledge seems also to be a keystone of medical prediction. In the opening section of the *Prognostica,* we are told that prediction must come hand-in-hand with an understanding of the diseases one is trying to predict:

> γνῶναι οὖν χρὴ τῶν παθέων τῶν τοιουτέων τὰς φύσιας, ὁκόσον ὑπὲρ τὴν δύναμίν εἰσι τῶν σωμάτων, ἅμα δὲ καὶ εἴ τι θεῖον ἔνεστιν ἐν τῇσι νούσοισι, καὶ τουτέου τὴν πρόνοιαν ἐκμανθάνειν.
>
> "It is necessary, therefore, to learn the natures of such diseases, how much they exceed the strength of men's bodies, and to learn how to forecast them."[21]
>
> - *Prog.* 1.19-23

So we can see that there is a divide between the divine and the technical in the Hippocratic medical writings, and that the hallmark of these technical predictions is their application of specific, understood signs, coupled with specialist knowledge. This chimes well with the content of the Chrysippus fragment with which I began this discussion; it too stated that divine and technical predictions are different, and that

[19] The Hippocratic *Prognostica* is the clearest example of this method being described and applied. See Edelstein (1967) 70-81 describes the role of prognostics in the Hippocratic works *On the nature of man, On the number seven, On diseases I, Prorrhetikon I & II, Epidemics III, On regimen in acute diseases,* and *On wounds in the head.* See also Nutton (2004) 88-90.
[20] Potter's (1995) translation.
[21] Jones' (1923) translation.

medical predictions are made through the application of medical knowledge. It also, however, told us that predicting the weather is like predicting disease; it too is technical rather than divine, and based on knowledge built up through experience and the observations made by sailors. Indeed, if we look at the process of weather prediction by weather signs in this way we can see the similarities. It too relies on the application of signs that carry a specific meaning when a specific set of circumstances occur. It is also true that the use of weather signs relies on a body of underlain technical (specifically astronomical) knowledge, as I have argued in the previous chapter, as well as the knowledge of the significance of individual signs. At no point in this prediction process is the judgement of a god being interpreted, and even where there appears to be divine influence, such as in Aratus' *Phaenomena*, which is our only Greek text with an extended account of weather signs to see any kind of link between the gods and weather signs, we saw that a 'technical' layer of understanding actually separated the human and the divine. Just as medical prediction is the opposite of prediction by divination, then, so we can see that weather prediction can be viewed in the same way, as Chrysippus does.

Although I have argued here that there is a conceptualised divide in the Greek world between divine and technical prediction, and that this applies to weather prediction, I think that it was possible for this line to be occasionally deliberately blurred. We can see this by re-looking at a sign I have already discussed. In book 1 of Apollonius' *Argonautica*, while the Argonauts slept, and Akastos and Mopsos kept guard, a bird appears and is interpreted by Mopsos:

> ἡ δ' ἄρ' ὑπὲρ ξανθοῖο καρήατος Αἰσονίδαο
> πωτᾶτ' ἀλκυονίς, λιγυρῇ ὀπὶ θεσπίζουσα
> λῆξιν ὀρινομένων ἀνέμων· συνέηκε δὲ Μόψος
> ἀκταίης ὄρνιθος ἐναίσιμον ὅσσαν ἀκούσας.
> καὶ τὴν μὲν θεὸς αὖτις ἀπέτραπεν, ἶζε δ' ὕπερθεν
> νηίου ἀφλάστοιο μετήορος ἀίξασα·
> τὸν δ' ὅγε, κεκλιμένον μαλακοῖς ἐνὶ κώεσιν οἰῶν,
> κινήσας ἀνέγειρε παρασχεδόν, ὧδέ τ' ἔειπεν·
> "Αἰσονίδη, χρειώ σε τόδε ἱερὸν εἰσανιόντα
> Δινδύμου ὀκριόεντος ἐύθρονον ἱλάξασθαι
> μητέρα συμπάντων μακάρων, λήξουσι δ' ἄελλαι
> ζαχρηεῖς·
>
> "A halcyon flew above the blond head of the son of Aison, and with a cry foretold the end of the blowing winds. Hearing it, Mopsos understood the fortuitous meaning of the shore-bird. But a god turned the bird, and darting up, it perched on the top of the ship's post. Immediately he went to Jason, who was asleep on soft sheepskins, woke him and said:

> Son of Aison, you must climb to the holy place of rugged Dindymon to appease the well-throned mother of all the gods; then the gusting winds will calm."
>
> - *Argon.* 1.1084-1095.

The appearance of this bird is usually read as a fairly straightforward single divine omen.[22] However, getting to the meaning of the appearance of this halcyon is actually a more subtle, two-step process. At first, the bird appears, makes a noise, and the meaning is clear – the winds will abate. Mopsos, we are told, understands its significance, συνέηκε δὲ Μόψος. If the bird's significance were to stop here, we would probably read this as a straightforward weather sign. But it does not, and a god becomes involved. The significance of the bird, with the god's involvement, changes – and now indicates that a ritual must take place. That Mopsos' recognition of the bird comes initially after the first step indicates, I believe, that the two meanings are being individualised, and could be thought of as separate; there is an interpretation opportunity after the bird's first action, or its second.

Apollonius is here, I would suggest, playing with the boundaries between technical and divine prediction. What seems at first simply a sign for the interpretation of the technical type quickly changes, just as the bird's course does, and becomes divine. For a blurring of division to work, of course, such a division needs to exist before hand, and be sufficiently accepted for the manipulation to be acknowledged. If the significance of this passage is as I have described, it is striking that our main evidence for the clear definition, and deliberate manipulation, of these boundaries are Hellenistic in origin. As nothing more than a speculative suggestion, perhaps it was the composition and distribution of Aratus' *Phaenomena*, with its interest in weather signs, that inspired attention in this area. A clear division in Greek thought between divine and technical prediction is nonetheless evident. We can now turn to our Roman sources, and look at the extent to which this division is mirrored or altered. Cicero's *De Divinatione*, dating from around 44BC[23] features the earliest extant mention of weather signs in Latin literature, and so forms our starting point.

The *De Divinatione* is constructed in two opposing books. In the first, Quintus,[24] Marcus' brother, presents arguments that aim to prove that divination is a reliable practice. The second book contains Marcus' arguments against divination. In their

[22] See, for example, Hunter (1993) 82 with n.33.
[23] On the dating of this text, see Wardle (2006) 37-43.
[24] To avoid confusion I will refer to the author of the *De Divinatione* as 'Cicero', and the characters in the dialogue as 'Quintus' and 'Marcus'. On how the speakers are not to be associated with the real people see Beard (1986) 32-6.

arguments, both men discuss the nature of weather prediction and the extent to which weather signs have a place in a discussion about divination and the prediction of the future. Let us begin by outlining the arguments made by each brother concerning this topic.

At 1.9, Quintus gives his definition of 'divination':

> *…de divination, quae est earum rerum, quae fortuitae putantur, praedictio atque praesensio.*
>
> "…divination, which is the foreseeing and foretelling of events considered to happen by chance."

In addition to this basic definition, Quintus tells us that to genuinely count as divination, a prediction must be based not on specialist, technical knowledge, but must be the result of some divine inspiration[25]:

> *Horum sunt auguria non divini impetus, sed rationis humanae; nam et natura futura praesentiunt, ut aquarum eluviones et deflagrationem futuram aliquando caeli atque terrarium…quos prudentes possumus dicere, id est providentes, divinos nullo modo possumus; non plus quam Milesium Thalem, qui, ut obiurgatores suos convinceret ostenderetque etiam philosophum, si ei commodum esset, pecuniam facere posse, omnem olean ante quam florere coepisset, in agro Milesio, coemisse dicitur. Animadverterat fortasse quadam scientia olearum ubertatem fore…Multa medici, multa gubernatores, agricolae etiam multa praesentiunt, sed nullam eorum divinationem voco…"*
>
> "Some of these men make predictions, not as the result of direct heavenly inspiration, but through human understanding. For from nature they predict certain events, such as a flood, or the future burning up of heaven and earth…Such men we may call 'foresighted' – that is 'able to foresee the future'; but we can in no way call them divine; no more than we can Thales of Miletus, who, as the story goes, in order to confound his critics and thereby show that even a philosopher, if he see fit, can make money, bought up the entire olive crop in the district of Miletus before it had begun to bloom. Perhaps he had observed, from some special knowledge he had on the subject, that the crop would be abundant…Lots are predicted by doctors, captains, and farmers - but I do not call the predictions of any of them divination."
>
> - *De Div* 1.111

In casting this division between technical and non-technical predictions, we can see that the Roman conception of prediction is, in essence, the same as the Greek; some are made by experts, some are not. Indeed, Quintus' examples of people who predict by using 'technical' knowledge are, for the most part, all now recognisable from their

[25] This is based on the Stoic view that 'if there is divination, there are gods' and 'if there are gods, there is divination'. See *De Div.* 1.82-3 with Wardle (2006) 308-311.

frequent appearances elsewhere in this thesis: physicians, captains, and farmers. Examples of their predictions are, respectively, the positive or negative effect of particular remedies, predicting the weather through weather signs, and observing blossoms to know when to plough (all given at *De Div.* 1.16); all of these predictions are seen to be founded in specialist knowledge.

Quintus goes on to argue that weather signs, although in the category of specialist knowledge, look a lot like divination:

> *Age ea, quae quamquam ex alio genere sunt, tamen divinationi sunt **similiora**, videamus…*
>
> "But come, let us consider instances, which although outside the category of divination, **resemble** it very closely…"
> - *De Div* 1.13

The word *similiora* is significant here. It forms the explicit statement that weather signs are like divination. Kany-Turpin suggests that the comparison being made between the two here is one based on the similarities between the signs use as weather signs and those used as portents.[26] As I noted earlier, both use natural signs to make their predictions, so this seems likely. This comparative statement is followed by a six line translation of lines 909-912 of Aratus' *Phaenomena*, to which I will return periodically throughout the next chapter. I would suggest, however, that there is also a broader comparison being made – that both divination and weather prediction are doing similar things – making judgements about future events. In both form and function, using portents is like using weather signs. In Cicero's work, though, these similarities go further.

Marcus agrees with Quintus' classification of weather signs as outside divination, stating that he was quite correct to distinguish predictions made through skill from any concept of divination:

> *Sed animadverti, Quinte, te caute et ad eis coniecturis quae haberent artem atque prudentiam, et ab eis rebus quae sensibus **aut artificiis** perciperentur, abducere divinationem eamque ita definire.*

[26] Kany-Turpin (2003) 367-8. His article focuses on the way in which Cicero makes comparisons between weather prediction and prophecy. He does not, as I am doing here, argue for any degree of conflation between the two. He does, however, note that Quintus' inability to explain weather signs, about which I will discuss below, seems to blur boundaries somewhat: Kany-Turpin (2003) 373.

> "But I observed, Quintus, that from conjectures based upon skill and experience in public affairs, from those drawn from the use of the senses and from those made by persons **in their own callings,** you prudently withdrew divination."
> -*De Div.* 2.13

If divination were to exist, then, both brothers agree that weather signs would not belong within it, since the predictions are made through technical means and are thus removed from divine inspiration. That the weather sign section of Aratus' *Phaenomena* is used to provide evidence of non-divine prediction is a curious thing. After all, in the world-view of that poem weather signs are in fact divine by establishment:[27]

> …πάντα γὰρ οὔπω
> ἐκ Διὸς ἄνθρωποι γινώσκομεν, ἀλλ' ἔτι πολλὰ
> κέκρυπται, τῶν αἴ κε θέλῃ καὶ ἐς αὐτίκα δώσει
> Ζεύς·
>
> "For we men do not understand everything from Zeus, but still much is hidden, of which, if he wishes, Zeus will give us."
> - *Phae.*768-771

Weather signs could therefore have quite easily been bundled up with the divine prediction of the future. The fact that Cicero had read Aratus' *Phaenomena* but had not picked up on this as a potential point of contact between weather signs and divination could perhaps demonstrate that he was reading Aratus' weather signs more within the scientific framing, which is in line with the depiction of them in the *De Divinatione*, than with looking for any religious significance. This situation is somewhat paradoxical, however, since Cicero does come to write about weather signs in the religious context of the *De Divinatione*.

The paradoxes of the weather signs in the *De Divinatione* do not stop there. Despite being explicitly <u>not</u> divination, something rather curious occurs with Cicero's language when he discusses weather signs. As we saw above, the Greek terminology used with reference to weather signs is very restricted, focusing primarily on the simple idea of 'signs' that 'signify'.[28]

Therefore, in Cicero's discussion of weather signs, which explicitly employs translations of Greek sources, one would expect to see language associated with *signa*, the Latin equivalent of σῆμα, and indeed, we do have instances of this; for example:

[27] For more on this passage, see p. 58 and 72 above.
[28] See p.44 above.

> *Sic ventorum et imbrium **signa**, quae dixi, rationem quam habeant, non satis perspicio;*
>
> "Thus as to the cause of those premonitory **signs** of winds and rains already mentioned I am not quite clear;"
> - *De Div.* 1.X.16

Here, the terminology is the same as the Greek, with weather signs described simply as 'signs'.

In addition to this '*signa* language', however, we find other terms used. In particular, cognates of *praesensio* are employed when discussing weather signs. So we have the following example, featuring Quintus' description of Marcus' translation of Aratus' weather signs:

> *Atque his rerum **praesensionibus** Prognostica tua referta sunt.*
>
> "Your *Prognostics*, is full of these **warning signs**."
> - *De Div.* 1.VIII.13

What is perhaps most noticeable about this statement is that Cicero makes use of the word 'prognostics', a Latinisation of the Greek term, only as the title of his Aratean translation. When describing the content of this work, the actual weather signs themselves, the word *praesensiones* is used. This same term, however, is used in Marcus's definition of divination at the very beginning of the *De Divinatione*:

> *…divinationem, quam Graeci* μαντικήν *appellant, id est **praesensionem** et scientiam rerum futuram.*
>
> "… divination, which the Greeks call 'mantikē', is the **foresight** and knowledge of future events."
> - *De Div.* 1.I.1

Here we see *praesensio* linked explicitly to divination; divination is 'foresight', it is *praesensio* at the most fundamental meaning of the word. But in the previously cited passage, we can see that *praesensio* is also just as easily used for weather signs; there appears here to be no differentiation between the uses. It could be that the term was applied as generally and widely as the *signa* language was. However, the noun *praesensio* is, at least until the 4th century AD, where it appears occasionally in the writings of Augustine, a uniquely Ciceronian word; its first appearance and subsequent further uses are solely in the works of Cicero,[29] and it is therefore possible that it was a

[29] 16 times in the *De Divinatione*; 5 in the *De Natura Deorum*; once in the *Topica*.

term developed by him.[30] If this is so, he consciously chose not to differentiate predictions made by divination and those made by technical means through the vocabulary applied to them.

Indeed, he seems to have employed a term which, to his mind, is much more closely connected with divine prediction. Of the 22 instances of the word, only three do not refer to the practice of divination: 2 from the *De Divinatione* when it refers to weather signs,[31] and once in *De Natura Deorum*, where it appears to refer to a pre-conceived idea.[32] On the one hand, then, Cicero discusses weather signs as providing explicitly non-divinatory predictions, and on the other, he uses a term which he himself used, or perhaps even invented, to define divination to refer to these technical predictions, despite them being conceptually different. How can we account for this troubling paradox?

As I have already stated, it appears that the Romans of the 1st century BC, when presented with weather signs as an intellectual topic for discussion, could not help seeing the parallels between divination by portents, which was widely practiced and made up a fundamental part of Roman politics and religion, and the use of weather signs. As a result, I suggest a partial conflation between the two occurred. At one level, a basic similarity of the idea of 'natural sign and meaning' was recognised and, as we have seen, at a linguistic level, a binding together of the two with the same terminology occurred, reflecting the similarities of the aims of the methods of 'future prediction'. Cicero's *De Divinatione* is not the only place we can see this conflation occurring. The first book of Vergil's *Georgics* provides us with interesting evidence of the same phenomenon. In this text, a list of weather signs and a list of portents are fused together, connected by their appearance and function. I will here discuss two aspects of this section of the *Georgics*; firstly, the structure of the end of book 1 as a means to understand how the lists relate to one another, and secondly, the literary precedents on which Vergil relies and what they can tell us about the novelty of the ideas and connections made in the text, thus providing further evidence for the fact that the conflation of weather signs and portents is a peculiarly Roman innovation.

The end of *Georgics* 1 can be summarised as follows:[33]

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[30] Cicero is well known, of course, for coining Latin philosophical terminology; see Powell (1995) 288-297.
[31] Both in 1.13.
[32] 2.45 – though even this is within the context of a discussion of the nature of the divine, and in a text in which *praesensio* is employed to refer to divination.
[33] Broadly following Thomas's (1988) divisions.

Lines	Contents	Description
311-350	'The Great Storm'	Description of a powerful storm, which lays waste to man's agricultural efforts and roughens the sea.
351-463	Weather Signs	List of weather signs, structured as: bad weather – good weather – moon signs – sun signs.
463-487	Ill-boding Portents	List of portents, beginning with the sun, ending with a comet and including signs from, amongst others, animals, statues and rivers.
489-514	Civil War	Description of the effects of civil strife including farmers uncovering bones and weapons in their fields.

That the sketch of the storm and the description of civil strife stand in parallel to one another has now been recognised for some time. This view has been elegantly summarised by Richard Thomas:

"The famous close of the first book with its enumeration of portents attending the assassination of Caesar and leading to civil war, with the expression of hope that Octavian will deliver the world from its ills, and with the final simile of the charioteer out of control and careering to his destruction, stands in the same relationship to the preceding technical material as the storm scene of 311-50. As that storm came unseasonably and in spite of man's precautions, so comes the storm of civil discord; the sun may tell of its coming…but that is of little comfort or aid."[34]

The storm and civil war thus stand not only in parallel to one another as acts of destruction, but also because both are predictable from signs, if fundamentally unpreventable. There is, then, a mirrored symmetry to the close of this book. The storm is followed by its signs, which are in turn followed by portents and the civil war: event-signs-signs-event. As a result of this structure, the weather signs and portents also stand as counterparts to one another, just as the storm and war do. As has been often observed, the list of portents emerges virtually seamlessly from the list of weather signs.[35] To such a degree is this true, in fact, that the transition between the weather signs and portents begins mid-line and enjambs into to the next:

> *Denique, quid vesper serus vehat, unde serenas*
> *ventus agat nubes, quid cogitet umidus Auster,*

[34] Thomas (1988) 144.
[35] Wilkinson (1969) 159; Thomas (1988) 145.

sol tibi signa dabit. ***Solem quis dicere falsum***
audeat? *ille etiam caecos instare tumultus*
saepe monet fraudemque et operta tumescere bella.

"In short, what drives the late evening, from where the wind moves the clear clouds, the purpose of the rainy south wind – the sun will give you signs of these. Who dares say the sun is false? He and no other warns us when dark uprisings threaten, when treachery and hidden wars are gathering strength."
- *Georgics* 1.461-5.

The beginning of a new topic is not clearly announced in these lines, nor do the portents begin at the start of a line, signalling a fresh start. It could be argued, however, that the mention of *bella*, war, should indicate to us a change in topic. This war, though, could easily, and, in fact, on first reading probably is by most, taken to be a metaphor for the storm. Miles has noted that lines 316-327 within the description of the storm are cast as a military metaphor[36] and that *tumultus* in the above passage aids the transition between meteorological and political matters because it can mean both a storm, and a civil disturbance.[37] Following this line of thought, if we consider the whole close of book 1, we find that language comfortably at home in military contexts litters the entire passage:

[36] Miles (1980) 100-1.
[37] Miles (1980) 104. For *tumultus* referring to impending civil war, see Lintott (1968) 91-2.

Line Reference	Vocabulary	Notes
1.318	*ventorum…proelia*	*proelia* used for the 'battle of the winds' i.e. blowing in different directions. For its use in the context of human war, see e.g *Aeneid* 12.526.
1.322	*agmen aquarum*	*agmen* used here of a 'column' of water, but can be used of an army; see e.g. *Georgics* 2.280.
1.358	*fragor*	Used of a 'crash' heard from the mountains. Also used of wailing of grief during war – see e.g. *Aeneid* 11.214.
1.362	*clamorem*	Here the cry of a gull, but can also be used for a battle cry – see *Georgics* 4.76.[38]
1.376	*patulis…naribus*	Here relates to cows, but this image is more normally used of horses in battle, see e.g. Lucr. *DRN.* 5.1076.
1.381	*agmine magno*	Here a group of crows; for *agmen* elsewhere, see above in this table.
1.426	*insidiis*	Here of being caught unawares by the weather, but can have the technical military meaning of an ambush, see *Aeneid* 12.336
1.448	*defendet*	Here of guarding grapes from rain, but commonly used in military contexts, see e.g. *Aeneid* 2.292.
1.464	*tumultus*	Used here of the storm, but, as Miles notes, can also be used of military exploits, especially civil war. See p.113 n.37 above.

This table shows us that right from the very start of the storm description, the weather is described as being, with varying levels of explicitness, like a war. Battle language is therefore not reserved solely for the civil war section, but underlies the whole end of book 1 as it builds to its martial climax. Thus language further unites the weather signs and portents, substantially aiding the impression that we move from one to the other almost completely unknowingly.

The change of focus from the list of weather signs, which immediately precede this passage, is indicated by the question "who dares say the Sun is false?". It is around this question that the two lists pivot; everything before it concerns the weather, and with an understated ease, everything after it is about civil war. One of the reasons the lists blend so well together is the simple fact that weather signs look a lot like portents in Vergil's descriptions. Take these two examples, the first from the weather signs:

[38] Manolaraki (2012) 294 notes that *clamor* typically denotes human voice.

continuo uentis surgentibus aut freta ponti
incipiunt agitata tumescere et aridus altis
montibus audiri fragor, aut resonantia longe
litora misceri et nemorum increbrescere murmur.

"So, when winds were rising, either the sea's straits begin to heave and swell, and on the mountain heights is heard a dry crash, or the shores ring a confused echo afar and the woodland murmur sounds out loud."

- *G.*1.356-60.

And the second taken from the portents:

armorum sonitum toto Germania caelo
audiit, insolitis tremuerunt motibus Alpes.
uox quoque per lucos uulgo exaudita silentis
ingens …

"Germany heard the noise of battle across the sky and the Alps rocked with strange tremors. A huge voice boomed through the silent groves for all to hear…"

- *G.*1.474-7.

These two passages could quite easily appear in the same list. Firstly, regardless of Vergil's style, the two passages employ strikingly similar phenomena to act as signs; the former describes a heaving sea, and sounds emanating from mountains, the shore and forests and the latter sounds from the sky, earthquakes and sounds from groves. Thus both passages focus on unusual or loud noises produced from a variety of natural settings and we can therefore see that the types of events that are taken to be weather signs are sometimes virtually identical to those taken to be portents. Secondly, Vergil's style in the weather sign and portent sections does much to unify them. Both are constructed in a 'list' style, with each phenomena appearing rapidly one after another, and featuring very little description. The events in each list could therefore be almost interchangeable.

The "who dares say the Sun is false?" question, however, also provides us with another connection between portents and weather signs; that of their function. The question draws attention to the fact that for both weather signs and portents, trust is being placed in natural phenomena, with the hope that from them, one can make reliable predictions. This similarity is emphasised by the lists being placed directly next to one another around the pivot phrase. This establishes them as counterparts to one another both by their corresponding placement within the wider symmetrical construction of the end of the book, and by the physical connection of the lists by the pivot itself, which stands to point out their functional likeness. This functional similarity between weather

signs and portents is therefore put at the centre, both figuratively and literally, of their depiction.

The two lists therefore seem to sit in such a way as to highlight their similarities and there can, I think, be little doubt that the weather signs and portents are viewed as being similar to one another in basic form and function. The *Georgics*, though, can also provide us with further evidence for the fact that the recognition of this closeness of weather signs and portents is a Roman development.

As stated above, in this closing section of *Georgics* 1 Vergil is making a series of connections between topics and events. Most clearly demonstrated by the symmetry of the section here have been the link between storm and war, and the association of weather signs with portents. I will here demonstrate that while to achieve the former connection, Vergil had a clear single Greek precedent, to make the latter required a fusing of influences, indicating that this relationship between weather signs and portents was a new, innovative, Roman one. Let us begin, then, with storm and war.

Both storms and war as separate topics were, of course, nothing new in poetry when Vergil came to write his *Georgics.* War formed the central setting for epics such as Homer's *Iliad* and there had already a number of notable descriptions of storms Vergil appears to have drawn on for his description, not least in the *Iliad*, Hesiod's *Works and Days* and Lucretius' *De Rerum Natura*.[39] What we are interested in here, though, is the sources Vergil made use of to articulate the parallels between a storm and a civil war. It has convincingly suggested that Apollonius' *Argonautica* is the source to which Vergil looked.[40] Specifically, he was recalling *Argonautica* 4.1278-89, in which war, plague, storms and portents are mentioned in a simile describing the Argonauts confusion after being shipwrecked:

> ...ἐν δ᾽ ἄρα πᾶσιν
> παχνώθη κραδίη, χύτο δὲ χλόος ἀμφὶ παρειάς.
> οἷον δ᾽ ἀψύχοισιν ἐοικότες εἰδώλοισιν
> ἀνέρες εἰλίσσονται ἀνὰ πτόλιν, ἢ πολέμοιο
> ἢ λοιμοῖο τέλος ποτιδέγμενοι, ἠέ τιν᾽ ὄμβρον
> ἄσπετον, ὅς τε βοῶν κατὰ μυρία ἔκλυσεν ἔργα,
> ἢ ὅταν αὐτόματα ξόανα ῥέῃ ἱδρώοντα
> αἵματι, καὶ μυκαὶ σηκοῖς ἔνι φαντάζωνται,
> ἠὲ καὶ ἠέλιος μέσῳ ἤματι νύκτ᾽ ἐπάγῃσιν
> οὐρανόθεν, τὰ δὲ λαμπρὰ δι᾽ ἠέρος ἄστρα φαείνοι·
> ὣς τότ᾽ ἀριστῆες δολιχοῦ πρόπαρ αἰγιαλοῖο

[39] Thomas (1988) 121 notes the following: Hom.*Il*.16.384-92; Hes.*W.D.*507-16; Lucr.1.271-6; 6.253-61. For discussion of how and where Vergil alludes to/uses these texts, see Thomas (1988) 121-127.
[40] Thomas (1988) 145; Mynors (1990) 93.

ἤλυον ἐρπύζοντες...

> "All their hearts went cold and the colour drained from their cheeks. As when men roam through a city like lifeless ghosts, awaiting the destruction of war or plague or a terrible storm which swamps the vast lands and cattle work; without warning the cult statues sweat with blood and phantom groans are heard in the shrines, or in the middle of the day the sun draws darkness over the heavens and through the sky shine the bright stars: like this the heroes then wandered in aimless distress along the stretches of the shore."

Not only do we here get war and storms seen as similar as acts of destruction, as they are in the *Georgics*, we also have them as identifiably predictable disasters, also familiar to us from the *Georgics*, since firstly the men of the town are expectantly 'awaiting' (ποτιδέγμενοι) the destruction and secondly, and most significantly, there is a series of portents. Thus Apollonius' provides omens for the inevitable destruction of the town and countryside. That a couple of the portents that appear in Apollonius' list also appear in Vergil's list[41] proves very little since these are common omen types, which appear elsewhere.[42] But, as Thomas rightly states, war, storms and portents are bound up in this short Apollonian passage, and this is very similar to how they are used in the *Georgics*. This is the most compelling evidence that Vergil "found the seed for [his] passage" here.[43] It also demonstrates that for three of the four elements that constitute the close of book 1, Vergil had a template that already made some of the connections he himself was going to make; predictability, destruction, war and storms are already linked together. One element is missing, however; the weather signs.

For inspiration for this section Vergil turned, as I have already mentioned, to Aratus' *Phaenomena* via the work of Varro Atacinus and Cicero.[44] The inclusion of this text makes an important point. As has been demonstrated here, Vergil is making a link between weather signs and portents. To make this connection, he could no longer just use a single source of inspiration. Apollonius gave him a way of connecting storms, war and portents, but offered nothing for how weather signs could be linked to these. The very fact that Vergil was forced to find another text that discussed the weather signs, and to manufacture the recognition of the similarities between weather signs and portents himself, further demonstrates to us that this conflation was something

[41] Sweating statues: *G.*1.480; Eclipse: 1.467-8.
[42] Examples of eclipses as omens: Homer, *Od.* 20.356 (for a study of which, see Baikouzis & Magnasco (2008)); Archilochus Fr.122; Herodotus 1.74 (predicted by Thales) and 9.10;
Sweating statues appear in Cicero's omen list at *De Div.*1.97-8 (on which, see below), and are known to have been recorded in earlier Roman omen lists (see Obsequens' list, chapter 54). They also appear in Posidippus Epigram AB 30.
[43] Thomas (1988) 145.
[44] Thomas (1988) 127.

happening in 1st century BC Rome and was thus part of the Roman reception of weather signs.

The conflation in the Roman mind between weather signs and portents did not stop with the broad comparative scheme we have seen playing out thus far. Greek weather signs had, I think, a more concrete influence on portents when they began to be considered in detail in Rome, affecting the way that portent lists could be organised. I believe it to be the case that when presenting lists or selections of portents, some Roman authors used the quasi-formalised organisation that was present in Greek weather sign lists, which I discussed in the previous chapter. It should be stressed, however, that I am not proposing this idea as a catch-all 'key' for interpreting all lists of Roman portents. Rather that it helps to strengthen the connection between weather signs and portents I am arguing for.

2. Predictions and Portents 2: Form and Structure

To establish whether the 'traditional' structure of Greek weather sign lists had any influence on Roman portent lists, we must first ask whether the Roman authors recognised that there was a broad structural convention linking the Greek lists. To recap this briefly, with the Greek lists, I argued for (1) the unity of the structure within the *De Signis* and (2) that the structural priorities seen in the *De Signis* are the same as in the *Phaenomena*, thus unifying the conventions of structure more generally. The priority I argued for was fundamentally a practical, observational one which resulted in 'preferential treatment' being given to the sun, moon and, sometimes, but not always, specific fixed stars and constellations. This 'preferential treatment', I argued, was due to the potential regularity of appearance of these phenomena and could be expressed either by signs from these sources appearing first in lists (as in the *De Signis*), and/or by being individualised (as in the *Phaenomena*). Geminus' comments on Aratus' ordering showed us that 'sun- moon- stars- other signs' was the typical structure for these lists, but any structure that in some way favours signs from these sources is justifiable. For the period covered by this thesis, there are three texts to which we can turn to test whether this ordering was something noted and valued by Roman writers. Vergil's *Georgics* again, Lucan's *Pharsalia* and Pliny's *Natural History* all contain extended weather sign lists themselves and, importantly, appear to have consulted, or been influenced by, Greek sources.

As noted above, Vergil's weather sign list is structured as follows: signs of bad weather (1.351-92), then good weather (393-423), then signs from the moon (424-438) and finally, signs derived from the sun (438-63). As has been observed by Richard Thomas,[45] Vergil here appears to have roughly reversed the order of the signs given in his poetic model, Aratus' *Phaenomena*. The sun and moon now occupy the final position in the list, not the very first. Even with this reversal of the ordering, however, we still witness the sun and moon treated differently to other weather signs; they appear as individualised groups in a way that no other set of signs do. By doing this, Vergil reveals the debt his *Georgics* owes to the *Phaenomena*.

Lucan's list of *Pharsalia* 5.540-559 contains a list of around twelve signs of an approaching storm. The fisherman Amyclas gives first a series of signs taken first from the sun (541-545), then some taken from the moon (546-550) before listing those taken from nature, including from animals and birds (551-559). The conventional structure of the list thus seems to be elegantly on display in Lucan's passage.[46] The *Georgics* appears to be Lucan's primary model for this passage,[47] but it also possible that he was aware of Aratus' *Phaenomena*[48] and perhaps even other weather sign texts.[49] His application of a 'by sign-type' structure could suggest an additional influence other than the *Georgics* or the *Phaenomena*, who organise primarily by 'weather-type', but this is, of course, inconclusive because Amyclas is interested only in one weather type – the approaching storm. What is clear, however, is that Lucan's structure falls very neatly into the expected structural patterns seen elsewhere; he starts with the sun, discusses the moon before moving to signs from other sources.

Pliny conveniently summarises his list of weather signs, which appear at *NH*.18.78-90, in his contents to the whole work, which forms book 1:[50]

[45] Thomas (1988) 127.
[46] Morford (2001) 38, notes too this move from celestial to terrestrial.
[47] On this see Matthews (2008) 115-131.
[48] Matthews (2008) has picked up on a few instances in which Lucan appears to specifically have Aratus in mind e.g. line 541 (pg.120 in Matthew (2008))– red clouds at sunset as an indication of fair weather does not appear in Vergil, but does in Aratus' poem, at 858-61; the immense popularity of the *Phaenomena* (on which see Lewis (1992)) also makes familiarity with this text likely.
[49] Morford (1967) 39 suggests that Lucan may have had access to Varro, Aratus' various translators and Theophrastus (by which is meant the *De Signis*). It should be noted that Matthew's (2008) 115 statement that "compiling weather sign lists may have formed part of L[ucan]'s rhetorical training" seems to me a vast overstatement. The example she cites, from Seneca's *Suasoriae* 3.4-5 features a pupil wishing to emulate a line of Vergil's weather sign list from the *Georgics*. The interest in this example is not with the weather signs *per se*, but the style of Vergil.
[50] On these *summaria* in the Natural History, see Doody (2001).

> *(lxxviii-xc) Prognostica: a sole, a luna, stellis, tonitribus, nubibus, ignibus terrestribus, aquis; ab ipsis tempestatibus; ab animalibus aquatilibus, a volucribus, a quadrupedibus.*
>
> "([book 18, chapters] lxxviii-xc) Weather signs: from the sun, the moon, stars, thunder-clouds, mists. Earth-fires, waters; from the seasons themselves; from aquatic animals, from birds, from quadrupeds."

Following this contents entry, Pliny cites, as he does for all sections of the *Natural History*, the authorities he has consulted in the production of the section. Looking within this list for potential sources of weather sign information, we can find Theophrastus and Aratus. It thus seems highly probable that Pliny's list is informed by the consultation of Greek weather sign lists. As we would therefore expect, his summary makes it clear that the list is constructed along the conventions of weather sign lists, with the sun, moon and stars taking the opening spots. That this structuring is indeed explicitly indebted to the recognised conventions of weather sign lists will be argued further later. It is also noteworthy of this passage that while Cicero, as discussed above, uses the term *prognostica* as only the title of his work, and never refers to weather signs themselves by using that word, Pliny here employs it as the term for 'weather signs'. Evidently, then, the Greek texts on weather signs have, through a Ciceronian filter, provided the Romans with a vocabulary to use when discussing these predictions.

So we can state with some certainty that Roman authors of the 1st centuries BC and AD were being influenced by earlier Greek writers and were aware of the organisational paradigm employed by them. They evidently recognised that there was a standard pattern for the presentation of this material, and, indeed, chose to emulate it. Let us now then turn to consider lists of portents, and with it comes a slight shift of texts, as we replace Pliny, whose text does not feature a portent list, with Cicero's *De Divinatione*, whose text does. Thus we have three texts that are concerned with both weather signs and portents.

We must begin again with Cicero's text. At 1.97-8, Quintus gives a list of around twenty examples of portents from Roman history:

> *nam et cum duo visi soles essent, et cum tres lunae, et cum faces, et cum sol nocte visus esset, et cum e caelo fremitus auditus, et cum caelum discessisse visum esset atque in eo animadversi globi, delata etiam ad senatum labes agri Privernatis, cum ad infinitam altitudinem terra desedisset Apuliaque maximis terrae motibus conquassata esset. Quibus portentis magna populo Romano bella perniciosaeque seditiones denuntiabantur, inque his omnibus responsa*

haruspicum cum Sibyllae versibus congruebant. **98** *Quid cum Cumis Apollo sudavit, Capuae Victoria? Quid, ortus androgyni nonne fatale quoddam monstrum fuit? Quid cum fluvius Atratus sanguine fluxit? Quid? cum saepe lapidum, sanguinis non numquam, terrae interdum, quondam etiam lactis imber effluxit? Quid cum in Capitolio ictus Centaurus e caelo est, in Aventino portae et homines, Tusculi aedes Castoris et Poflucis Romaeque Pietatis? Nonne et haruspices ea responderunt, quae evenerunt, et in Sibyllae libris eaedem repertae praedictiones sunt?*

"When at one time, two suns were seen and, at another, three moons; when there were meteors; when the sun was seen at night; when rumblings were heard in the heavens; when the sky was seen to split, displaying masses within it; also when the landslip in Privernum was reported to the senate; and when the land sank to an incredible depth when Apulia was shaken by a most violent earthquake. With all these portents the Roman people were warned of mighty wars and deadly revolutions, and for all these, the responses of the soothsayers were in agreement with the Sibylline verses. **98** And what of when the statue of Apollo at Cumae and theVictory at Capua dripped with sweat? Or when that unlucky prodigy, the hermaphrodite, was born? Or when the river Atratus ran with blood? Or when there were often showers of stone, sometimes of blood, occasionally of earth and even of milk? And finally, when lightning strikes the statue of the Centaur on the Capitoline hill, the gates and some people on the Aventine and the temples of Castor and Pollux at Tusculum and of Piety at Rome – in each of these cases did not the soothsayers give prophetic responses which were afterwards fulfilled? And were not these same prophecies found in the Sibylline books?"

The little scholarly attention that this passage has received has revealed a close connection to the 4th century AD haruspical list of Julius Obsequens,[51] with half of the portents from Cicero's list appearing also in two annual entries from Obsequens' list.[52] Obsequens' list is an abridged and adapted version of a work of Livy, listing groups of portents by their year of appearance. MacBain has suggested that the later years of Livy's list was based on a work written by the 1st century BC historian Cornelius Sisenna. Sisenna's work was most probably the source of Cicero's portent list, thus explaining the parity between Obsequens and Cicero.[53] We can therefore take Obsequens' list as representing the kind of list Cicero was using to construct his:[54]

L. Scipione C. Laelio coss.

1. Iunonis Lucinae templum fulmine ictum ita ut fastigium valvaeque deformarentur. In finitimis pleraque de caelo icta. Nursiae sereno nimbi orti et homines duo exanimati. Tusculi terra pluit. Mula Reate peperit. Supplicatio per decem pueros patrimos matrimos totidemque virgines habita.

[51] For a general discussion of, and introduction to, Obsequens' list, see Rasmussen (2003) 21-22.
[52] Of the years 117 and 91 BC. See MacBain (1982) 21-3 and Wardle (2006) 336-343.
[53] MacBain (1982) 21.
[54] MacBain (1982) 22-3.

M. Messala C. Livio coss.

2. Luce inter horam tertiam et quartam tenebrae ortae. In Aventino lapidum pluviae novendiali expiatae. In Hispania prospere militatum.

" Consulship of Lucius Scipio and Gaius Lealius [190 BC]

1. The temple of Juno Lucina was struck by lightning, in such a way that the gable and the doors were damaged. In neighbouring towns many things were struck by lightning. At Nursia storm clouds gathered from a clear sky, and two persons were killed. At Tusculum there was a shower of earth. A mule at Reate produced a colt. A day of prayer was observed by ten boys with living fathers and mothers, and as many girls.

Consulship of Marcus Messala and Gaius Livius [188 BC]

2. Between the third and fourth hour of the day, darkness set in. On the Aventine, showers of stones were atoned for by the nine-day observance. There was a successful campaign in Spain."[55]

As we can see here, Obsequens' list is strikingly different in form to Cicero's. While Obsequens' primary organisational factor is chronology, listing the portents in an annalistic fashion, as are known to have been formally recorded,[56] Cicero's list is devoid of a chronological aspect and instead favours a different organisational priority.[57] Exactly what this priority is has thus far escaped Ciceronian scholars.[58] By looking to weather sign lists, however, I think we can offer an explanation for Cicero's structure. It will help us here to have Cicero's portents laid out in a clearer list form, and devoid of Quintus' comments:[59]

Two Suns
Three Moons
Meteors
Sun at night
Rumblings in heavens
Sky divided, with fireballs

Landslip
Earthquake
Land sinks

[55] Schlesinger's (1987) translation.
[56] In the *tabulae pontificum* /*Annales Maximi*, the yearly chronicles produced by the *pontifex maximus*. See Rasmussen (2003) 16.
[57] As MacBain (1982) 22 has noted.
[58] MacBain (1982) 21 n38 notes "I have found no discussion of the character or structure of the list in Pease's [1920-1923] *Commentary* on the *De Div.*, or elsewhere."; Wardle (2006) 336 says "the principle of organization behind the material is unclear".
[59] In each of the lists featured below, I have placed a line where I think a conceptual divide is being made between different types of portents. The exact categorisations I am depicting with these are discussed in the main body of the text.

Statues drip sweat
Hermaphrodite born
Atratus ran with blood

Showers of stone
Showers of blood
Showers of earth
Showers of milk
Lightning striking statue
Lightning striking people
Lightning striking temple of Castor and Pollux
Lightning striking temple of Piety

The first six portents here concern the sun, the moon, and other phenomena emanating from the heavens. We then have six portents from the earth, and more generally on a terrestrial level. The list finishes with eight portents which could perhaps be thought of as meteorological, but, significantly, have their main impact in the terrestrial realm, not the celestial. Strikingly, in Cicero's poem *de Consulatu Suo*, the longest fragment of which we have comes from *De Div.* 1.17ff, the same structure is adopted, but constructed from different individual portents: lines 11-24 detail 'celestial' omens, from the stars, celestial light, the Moon and the Sun; lines 25-32 list earthquakes, the appearance of ghosts and the announcements of prophets; lines 33-46 features the destructive effects of lightning on temples, animals and people.[60] This suggests that the organisational structure he has employed is an entirely deliberate one; he is very consciously placing portents in this specific order.

We can see in this ordering broad similarities with the weather sign structures discussed above, with a clear move from the 'heavenly' to the 'earthly'. This organisation of weather sign lists may have influenced how Cicero constructed his portent lists. However, rather than beginning with the specific 'sun, moon and fixed stars' arrangement (these favoured in the Greek system due to their observational regularity), Cicero includes other, less regular phenomena like meteors and fireballs in the sky. It would appear, then, that rather than the sun, moon or fixed stars being picked out, Cicero gives 'preferential treatment' to celestial phenomena more generally; anything occurring in the celestial realm is apt for inclusion. This is important. It shows us that here, the weather sign lists are being read not as lists of weather signs *per se*, but simply as lists which have a clear, set structure; it is not the reason behind the organisation of the list that is of interest, but the organisational pattern itself.

[60] Line numbers from Soubiran (1972). Of the two commentaries on this text, Eubank (1933) and Soubiran (1972), neither comment on the organisation of the list.

As well as this basic similarity in structure, we know that (1) Cicero had an interest in weather signs, and in Aratus' account of them in particular – from his quotes throughout the *De Divinatione*; (2) Cicero had, as I have demonstrated above, already begun to conflate weather signs and portents in his mind; and (3) the passage of the *De Consulatu Suo* referred to above reveals an Aratean influence.[61] This would rather suggest that when looking to construct his list of portents for this text, Cicero was looking very definitely to Aratus, and was, around the time of the composition of the *De Consulatu Suo*, perhaps even focussed at the time on his *Prognostica* in particular.[62] All this evidence together does, I think, make it entirely possible that the structure of Cicero's portent list was influenced by the structure of Greek weather sign lists.

Lucan's list of *Pharsalia* book 1.526-83 demonstrates a very similar structure to that seen in Cicero's work.[63] Here it is, again summarised in simple list-form:

Unknown stars appearing
Sky burns with fire
Lights shooting through heaven
A comet
Lightning in a cloudless sky
Fire from lightning forming shapes
Lightning hits the capital of Latium
Stars appearing at noon
Moon dimmed by Earth's shadow
Eclipse of the sun

Etna erupts, with flames falling
Bloody sea
Fire at Vesta's altar vanishes
Fire marking end of Latin Festival splits in two and rises up
Earth sinks
The sea floods the Earth
National gods shed tears
Household gods sweat
Offerings in temples fall from their place
Ill-omened birds appear
Wild animals came into the city
Animals speak
Women give birth to monstrous children
Bellona's worshippers chant and cut their arms
The Galli recite omens
Urns full of ashes groan
Crash of weapons heard in forests

[61] On this, see Kubiak (1994).
[62] See Kubiak (1994) 52; Gee (2001) 521.
[63] On the role of this portent list within the poem generally, see Roche (2009) 319.

Sound of ghosts in battle heard
Farmers near the city flee
Trumpets of war sounded
Night gave sounds of battle
Ghost of Sulla seen
Ghost of Marius seen

As with Cicero's portents, we here once again see the grouping together of a number of 'celestial' signs at the beginning of the list. Unlike Cicero's list, however, where lightning is included in the 'terrestrial' section of the portents, Lucan rolls it in to his 'celestial' grouping. This is, though, perhaps justified by the nature of the lightning here, which Lucan tells us emerges from a cloudless sky, entirely without sound (*emicuit caelo tacitum sine nubibus ullis/ fulmen* 1.533-4). It may therefore be that this is categorised not as the normal 'meteorological' lightning, but as something emanating from the celestial realm. It has been suggested that the similarities between Lucan and Cicero's portent lists can probably be accounted for by the fact that Lucan had read, and been influenced by, Cicero's *De Consulatu Suo*.[64] Given that Cicero's lightning section of that text is so definitely and strikingly individualised (it depicts Jupiter, standing upon Olympus, hurling the thunderbolts down) at the end of his list, whereas Lucan's lightning signs are placed amongst the stars, sun and moon at the beginning of his, I am unconvinced by the strength of this suggestion. Instead, taking into account the evidence mentioned above that indicates that Lucan may have been familiar with Aratus' poem itself, and the fact that he adopts the 'Greek' structure for his weather signs in book 5 again make it entirely possible, I think, that the weather sign lists influenced how Lucan chose to structure his portents. As with the Cicero passage above, Lucan here appears to be exploiting the structure of weather sign lists purely as an example of list structure, rather than being concerned with the nuances of and reasons for that structure. This can be especially seen in the fact that while in the weather sign lists, only very specific phenomena associated with the sun, the moon and the visibility of certain star groups are placed in prominent positions, as with Cicero's list, the 'heavenly' phenomena in Lucan's passage seem much more broadly defined; anything that appears celestial can be included.

Vergil, as we have already seen, makes explicit links between weather signs and portents in his *Georgics*. We have also seen that he appears to recognise the

[64] Gee (2001) 251 n.6. The list is, of course, influenced in theme by Vergil's portent list; see Thompson & Bruène (2009) 131-133.

standardised structure of weather sign lists. Let us, then, assess his list of portents, taken from *Georgics* 1.465-488:

(Eclipse of the Sun)
Etna erupts
Germany hears the noise of battle
Earthquake in the Alps
Booming voice through groves
Ghosts seen
Animals speak
Rivers stand still
Earth gapes open
Statues weep in temples
Statues sweat
Po floods forests
Ominous haruspices
Blood flows from wells
Hills echo with wolves' howl
Lightning from a cloudless sky
Comet appears

This portent list is different in structure to those that have been discussed above. It begins with a single celestial portent, before listing a mixture of earthly phenomena, and ends with two portents that, judging from the examples taken from Cicero and Lucan, should perhaps be grouped with the very first one. It could be argued that a single portent is a weak body of evidence from which to suggest the entire categorisation of 'celestial', but, what this table does not mention is that the eclipse portent is not a simple mention of one portent, but comes from a five line (464-8) exposition on the importance of the sun as a portent, thus making it appear more like a contained unit in its own right. The balance between celestial and terrestrial is therefore much less stark than the presentation of this list may make it seem, the terrestrial signs taking up fifteen lines.[65] Vergil's list moves from celestial to terrestrial and back to celestial, thus contravening the order of the weather signs. Attempts to see a direct parallel between the structure of the portent list and weather sign lists would therefore be fruitless. Even Vergil's own weather sign list is structured in such a way that the sun and moon signs appear only at the end; it cannot, then, provide a direct structural model for his portent list. I intend, therefore, to pursue a slightly different line of enquiry, but one that still sees the organisation of weather sign lists as an influence on Vergil's portent list. I will here suggest that Vergil employs not a direct organisational copy of weather sign lists,

[65] Thus the ratio, in terms of lines, is 1:3 celestial:terrestrial. In terms of number of signs, it is 1:14.

but instead applies the same broad organisational principles through the divisions he makes.

We have seen above that when applied to portent lists, the prominence of the sun, moon, and stars, due to their regularity in weather sign lists, began to represent a much more general, broader division between 'heavenly' and 'earthly' phenomena. It can also be stated that Vergil recognised that the sun and moon were handled differently to the other signs in Aratus' *Phaenomena*, since he treated them as a group when he transposed them from the start of Aratus' list to the end of his. Indeed, by making this move, Vergil appears to acknowledge the significance of object placement within a list structure. He does not bury the sun and moon in the middle of the list, but moves them from one extreme to the other. Where a list is preceded and followed by other information, both the very start of that list and the very end are prominent positions; the transitions between what precedes and what follows the list are brought to our attention, and thus the beginnings and ends of these lists are also. So in his weather sign list, it begins with the prediction of bad weather, thus allowing transition from, and further emphasising the nature of, the storm that was described prior to it, and it ends with the moon and the sun, expressing the tendancy to treat these signs differently, while aiding transition into the portents. This recognition of the significance of the extremes of lists is important.

A feature noted by scholars such as Thomas,[66] and one on which I have commented above, Vergil's two final portents are similar in nature to his first one; they all appear to be 'heavenly'[67] in the general sense expected from portent grouping seen in Cicero and Lucan. Given that Vergil does seem to use the extremes of lists to some deliberate effect, it seems unlikely that this ring-composition is mere coincidence. It would, of course, be far too difficult to argue here that Vergil's use of extreme positions in his portent list is a result of their similar use in weather sign lists; that kind of investigation would require a much more far-reaching study of ancient lists. I do, however, think that it is possible to further suggest that Vergil deliberately differentiates between heavenly portents and earthly ones, and that this is a reflection of a similar practice taking place in the weather signs.

As I have suggested, the placement of the 'heavenly' portents in the list would appear to pick them out as siginificant beyond the other portents. The difference

[66] Thomas (1988) 145.
[67] Though Thomas refers to them as 'meteorological'.

between the heavenly and earthly is, I think, highlighted through the summary that appears immediately after the discussion of the first sun portent:

> *tempore quamquam illo tellus quoque et aequora ponti,*
> *obscenaeque canes importunaeque uolucres*
> *signa dabant.*
>
> "Yet at that time the earth also and the plains of Ocean, ill-boding dogs and distressing birds, sent signs which heralded disaster."
> - *G.* 1.469- 471.

Here, the general types of portents to come are introduced, rather than a list of specific portents themselves. Vergil deliberately points to the 'earthly' nature of the portents that follow; although the list finishes with 'heavenly' phenomena, these are not mentioned in his brief description of the portent list. It seems to be the case, then, that Vergil is keen to make it absolutely clear that we are quite definitely leaving the sun behind and moving to address a slightly different theme. To further emphasise this point, *tempore quamqaum illo* begins a new line, thus opening the potential that we are beginning a new section and, as Thomas has argued, this phrase forms a "dramatic opening".[68] All this leads me to suspect that we are encouraged to view those portents that follow the first sun portent as different from it – specifically that they are 'earthly', where it was 'heavenly'. Making this distinction further aids, by blurring, the move from weather signs to portents; if the list of portents makes the same division that the weather signs do, it draws them closer together and makes them more difficult to distinguish at first glance.

Thus Vergil's division of portents is like that seen in Cicero and Lucan; between the heavenly (broadly defined) and the earthly. Similarly, this division would seem to be as a result of the same division taking place in the weather sign list. Vergil evidently recognised that the sun and moon were treated differently in lists of weather sign, and so to blur his two lists together as much as possible, he adopts the same division in his portent list. To express this division, and thus aid transition, he places the heavenly portents at the extremes of the list, as they typically are in weather sign lists. I would suggest, therefore, that it is not the precise structure of weather sign lists that influenced Vergil's portent list, but the practice of dividing between 'heavenly' and 'earthly' phenomena. The division itself then influenced how Vergil structured his portent list.

[68] Thomas (1988) 146.

This kind of Greek influence on Roman religious concepts is not without precedent. Roger Beck has demonstrated how aspects of Hellenistic science, and in particular, the representation of the cosmos in a proportionately arranged schematisation influenced the layout of three late Republican and early Imperial Roman religious buildings; the augural *templum* at Bantia, the Horologium Augusti and the mithraeum, the shrine of the initiates of Mithraism.[69] In doing so, Beck demonstrated that Greek scientific ideas could be compatible with Roman religious ones to such a degree that the religion could be very directly affected by the scientific ideas. I see a similar thing taking place between weather signs and portents, with apparently technical knowledge finding a resting place in religious thought. I do not, of course, wish to argue that this conflation is as substantial as that observed by Beck, not least because the weather signs do not appear to have had a direct influence on religious practice like the schematised cosmos does, but it does provide us with useful evidence for the receptive nature of Roman religion to scientific ideas.[70]

3. Conclusion

In this part, I have argued that weather signs were assimilated into Roman intellectual discourse (though they probably existed in Italy long before this) in detail in the 1st century BC, and in a peculiarly Roman way. They were, I have suggested, compared to the Roman practice of diving by portents, which was a proud and important part of Roman public and private life.

I have suggested that the comparisons were made on a purely functional level, that both systems aim to tell us something about future events, and also on the level of appearance and similarity of the signs themselves – both rely on animals, birds, meteorological events etc. This led to, in places, a conflation between the two, including on a linguistic level with the vocabulary that was employed. Importantly, we can see that the level and depth of conflation by these Roman authors is far greater than anything we saw in the Greek at the beginning of this chapter. We saw a blurring of the boundaries between weather signs and portents in the *Argonautica*, but this is certainly not on the scale of, or as explicit as, the comparisons and conflations we have witnessed in the work of Cicero and Vergil. Thus this process of reading weather signs against portents in such detail seems to be something that is Roman in its nature. We will later

[69] Beck (1994).
[70] For more on the adaptability of Roman religion, see North (1976).

see this connection and conflation of weather signs and portents being exploited by, and influencing, a number of Roman authors as they attempt to explain how weather signs work also.

Indeed I have also proposed that the tradition of portents affecting how the Romans read weather signs was not the only process taking place. The structure of lists of portents make it possible to suggest that the standardised list structure for weather signs developed by the Greeks was adopted when certain Roman authors came to compose lists of portents. We have seen above that Roman portent lists were officially and traditionally produced as annals, listing the portents according to the chronological sequence of their occurrence. But when these came to be abridged or re-organised, a structure strikingly similar to that used for weather signs is adopted, and by authors who have evidently read and studied texts featuring such lists. This may suggest the influence of the weather sign lists. In addition to this potential structural influence, we have also seen here how significant Aratus' *Phaenomena* was in the transfer of Greek knowledge into Rome. In the next chapter, we will see that he was actually just one of a number of such transitional authors.

Part 3: The Roman Weather Sign

Having seen how weather signs took root in the poetry and intellectual debate of the late Republic and early Empire, we can now turn to consider the extent to which they are portrayed as practical, and how their presentation compares to that of astrometeorology. As the discussion in the introduction to this thesis demonstrated, we need to make no change to the basic idea that weather signs and astrometeorology were separate and distinct predictive methods. What is required, however, is to look at whether the relationship between these two predictive methods changed when they became of interest to the Romans, and why any changes may have taken place. These questions will be the focus of this chapter. I will argue that with the Roman assimilation of Greek writing on weather prediction, the division between the methods widened and became more firmly crystallised. While astrometeorology, aided by the politicisation of astronomy and astrology, developed in sophistication and became fully integrated into Roman culture and operations, weather signs increasingly became merely nuggets of curious information, viewed as relics of an older, rural society. Never again in antiquity would weather sign lists on the scale of the *De Signis* be produced.

We must begin with a consideration of the state of weather signs just prior to this period, before moving on to assess it at either end of the chronological span of this chapter; first looking at Cicero and Varro, as representative of the early to mid-1st century BC, then Pliny the Elder, whose *Natural History* dates from around the late-1st century AD, and which will be read alongside Columella's *De Re Rustica*.

1. Pre-1st Century BC Prediction

There is no evidence for how or whether weather prediction was written about in Rome prior to the 1st century BC. Somewhat surprisingly, our earliest extant Latin prose source, Cato's *On Agriculture*, a manual on farming supposedly designed for use by *agricolae*,[71] which one would perhaps expect to deal with forecasting in some detail,

[71] See *On Agriculture* preface 4. This premise is gradually revealed to be untrue, as interest in agriculture switches to the overwhelmingly financial. On this see Toynbee (1965) 296; White (1973) 456. Indeed, it must be acknowledged that, rather like Hesiod's *Works and Days*, Cato's agriculture may well have served a purpose far beyond simply giving farming information: see Kronenberg (2009) 94-5 for this; however, for the opposite view, see Dalby (1998) 17, who argues that reading the text as anything other than seriously agricultural makes it full of "irrelevance and inconsequentialities".

does not discuss it at all. Instead, explicit references to the weather in that text are both few and rather ambivalent. They are quoted here:

- *Uti bonum caelum habeat; ne calamitosum siet;*

  "It [a farm property] must have good weather; it must not be liable to storms" - 1.2

- *Cum tempestates pluviae fuerint, quae opera per imbrem fieri potuerint: dolia lauari, picari, villam purgari…*

  "When there is rainy weather, what sort of work could have been done while it rained? Washing and pitching vats, cleaning farm buildings…etc." – 2.3

- *Scabiem pecori et iumentis caueto: id ex fame et si impluit fieri solet.*

  "Avoid sheep and ox scab, which tends to follow hunger and exposure to rain" – 5.7

- *Vento austro caueto nequam materiem neue uinum tractes nisi necessario.*

  "Do not handle tinder, or wine, under a south wind, unless essential" – 31.2

- *Ubi tempestates malae erunt, cum opus fieri non poterit, stercus in stercilinum egerito, bubile, ouile, cohortem, villam bene purgato…*

  "When the weather is bad and no field work can be done, shift dung to the dungheap, clean out the ox shed, the sheepfold, the hen-run, the farm buildings…etc." – 39.1

These passages demonstrate that the weather has a clear influence on farming practices. None of them, however, give us any indication of how the weather could have been predicted. In fact, it is not even clear that forecasting is going on at all in the text; the relationship between the farming work and the weather as depicted here could well be a reactionary one, with the work being done changing simply as the weather changes. It is difficult to imagine this being the case, however. Certain tasks would presumably require a prediction of the weather to be made in order to complete them in a timely fashion. As the third passage above implies, for example, shepherds and ox-herds need to ensure they can move their animals to shelter in time to avoid heavy rain, which is potentially damaging to their hooves. It has been very plausibly suggested that a basic rural astrometeorological system akin to that of Hesiod was in operation,[72] not least due to the potential presence of a Roman rural 'calendar', to which I will return later in this

[72] Lehoux (2007) 80.

chapter, and I think it highly likely that natural signs were similarly intertwined with stellar indicators as in the *Works and Days.* One feature that makes it likely that a basic form of astrometeorology is underlying Cato's work, again like the *Works and Days*, is the occasional reference to a basic calendrical astronomy; for example:

> *Pirorum ac malorum insitio per ver et per solstitium dies L et per vindemiam.*
>
> "Pears and apples may be grafted during the spring, for fifty days at the time of the summer solstice, and during the vintage." – 41.1

From such evidence, it is now generally accepted that Roman agriculture was traditionally thought, by Romans themselves, to rely on astronomical time-reckoning, which, as the quote above demonstrates, was primarily divided up seasonally.[73] When considering the *Works and Days* above, we saw this kind of stellar observation often accompanied weather prediction that used many of the same astral sources.

2. 1st Century BC/AD Prediction: Using Signs in Rome

Cicero and Varro

In Cicero's *De Divinatione*, weather signs are presented as practical predictors. As has already been noted, in his examples of 'experts' who make predictions using skill, Cicero includes the captain of a ship, who predicts the weather using weather signs:

> *Num igitur aut haruspex aut augur aut vates quis aut somnians melius coniecerit aut e morbo evasurum aegrotum aut e periculo navem aut ex insidiis exercitum, quam medicus, quam gubernator, quam imperator?*
>
> "Can, therefore, any soothsayer, augur, prophet or dreamer conjecture whether a patient will come safely out of his sickness, or that a ship will escape from danger, or that an army will avoid an ambush, better than a physician, a captain, or a general?"
>
> - *De Div.* 2.13

In his examples in this passage, Marcus highlights three situations for us; disease, battle and rough sailing. In all of these, lives are at risk if the predictions made by the 'experts' are incorrect; 'is divination so trustworthy that we should hand the prediction of these things over to seers, and thus risk our lives?' Marcus is asking Quintus. That the captain predicts with weather signs gives us, I think, some idea of how they were

[73] For further on this, see p.163ff.

viewed. For Marcus' question to attack Quintus' viewpoint, as is intended, weather signs must have been viewed as the typical way a captain could predict the weather in order to save a ship; they must have been sufficiently trusted that rejecting them in favour of divination would seem ill-advised. Similarly, Quintus himself seems to be happy with weather signs as a way of making forecasts:

> *Sic ventorum et imbrium signa quae dixi, rationem quam habeant, non satis prespicio; vim et eventum agnosco, scio, approbo.*
>
> "I do not adequately understand the explanation for the signs of wind and rain which I have mentioned; I recognise, I know and I vouch for their force and result." - *De Div.*1.16

This statement makes it clear that Quintus trusts weather signs. He confesses he cannot explain why they work, something to which we will return later, but he is evidently comfortable relying on their predictions. Prior to this above statement and elsewhere in the *De Divinatione*, Cicero has, as I noted above, his interlocutors quote from, and refer to, his translation of the weather sign section of Aratus' *Phaenomena* in order to provide examples of weather signs.[74] The translation itself is called *Prognostica* and its dating and process of construction has produced much scholarly debate.[75] I agree with Wardle's suggestions that the *Phaenomena* is chosen here not only because Cicero has a translation ready and waiting, but also because the text was apparently well known[76] and that studying the translations themselves reveals very little that has not already been said about Cicero's astronomical *Phaenomena* translations more generally.[77] I also agree that a careful selection process has taken place in order to choose the most suitable passages to include in the *De Divinatione*. This is discussed below.[78]

A text of Varro may provide evidence to support Quintus's position. Pliny's section on weather signs from the moon (18.348-9) is explicitly quoted from Varro (*apud Varronem ita est…*) but no details are given as to the nature or function of the

[74] Quotes: 1.13, 1.14, 1.15. References: 2.47.
[75] The main debate concerns whether the *Prognostica* was part of Cicero's *Phaenomena* translations, and thus completed early in his life, perhaps in 89 BC, whether it was a later project in the 60s BC, or whether it was a combination of the two. The most influential scholarly work on this remains Pease (1917), with additional work by Soubiran (1972) 9-16.
[76] Wardle (2006) 132. On Cicero's use of translation in his philosophical works more generally, see Powell (1995) and Jocelyn (1973).
[77] Wardle (2006) 133-4. Soubiran (1972) 14-5 concludes that any attempts to detect differences between the *Phaenomena* translations and the *Prognostica* ones are "uncertain". On Cicero's translation techniques in the astronomical sections after Soubiran, see Gee (2001); Siebengartner (2012).
[78] Page 173-5.

work from which they came.[79] For example, because all the signs in the passage are from the moon, we cannot know whether Varro's work, if indeed it dealt with other weather signs at length, was organised by sign type, or by weather type with the moon and sun individualised, in an Aratean fashion. Some indication of a potential context for Varro's weather signs is suggested by Vegetius. His *Epitoma Rei Militaris*, from the 4th-5th century AD,[80] notes the following:

> *Aliquanta ad avibus, aliquanta significantur a piscibus, quae Vergilius in Georgicis divino paene conprehendit ingenio et Varro in libris navalibus diligenter excoluit.*
>
> "Some things are signified by the birds, some by fish, which things Vergil in his *Georgics* perceived with almost divine insight, and Varro in his naval books painstakingly developed."[81]
>
> - Vegetius 4.41

It would seem, therefore, that Varro wrote a work on naval matters that included weather signs. Courtney has suggested this may be the *Ephemeris Naualis* that Varro reportedly wrote for Pompey's voyage to Spain in 77 BC[82] and rather optimistically gives a quote from the fourth century grammarian Nonius supposedly stemming from that work.[83] Taken with Quintus' comments on weather signs, and if Varro's work were indeed to date from the first half of the 1st century BC, I think it can be reasonably asserted that weather signs were being presented in writing as a practical way of predicting the weather.

The story of the discussions of weather signs in the 1st century BC is not, however, this straightforward. In his rebuttal in book 2 of the *De Divinatione*, Marcus is quick to point out that weather signs are often incorrect:

> *Atqui ne illa quidem divinantis esse dicebas, ventos aut imbres impendentes quibusdam praesentire signis (in quo nostra quaedam Aratea memoriter a te pronuntiata sunt) etsi haec ipsa fortuita sunt: plerumque enim, non semper eveniunt.*
>
> "You also said that the foreknowledge of impending storms and rains by means of certain signs was not divination, (in connection with which a number of verses from my translation of Aratus were quoted by you). Yet such

[79] As Sider and Brunschön, (2007) 19, have noted, Varro's *Res Rusticae* does not feature any weather signs.
[80] For discussion of Vegetius' text more generally and his place within ancient technical writing, see Formisano (2001) 34-54.
[81] Stelten's (1990) text and translation.
[82] On which see Dahlmann (1935) 1252.
[83] Courtney (2003) 246.

> coincidences 'happen by chance', for though they happen frequently they do not happen always."
>
> - *De Div*.2.14

Marcus' statement here provides us with a model for accessing the view of weather signs in the 1st century BC: "though they happen frequently they do not happen always". There is trust here, some acceptance that weather signs are capable of providing accurate predictions. But there is also a great deal of hesitation; they are also sometimes incorrect – *non semper eveniunt*. This view of weather signs is strikingly similar to that of the 3rd century BC texts that Cicero calls upon when writing the weather sign sections of the *De Divinatione* – primarily Aratus' *Phaenomena* but also, as we shall see later, Boëthus' philosophical works.

Do we, though, have any evidence for astrometeorology in this period? Fortunately yes, in the form of two Ciceronian poetic pieces, but by two different 'Ciceros'. The first is Marcus Cicero's early 1st century BC[84] translation of Aratus' *Phaenomena*, on which only a brief discussion is necessary here and to which I shall return periodically throughout this chapter. We saw above that the astrometeorology of *Phaenomena* employs risings and settings of specific constellations. Unsurprisingly, Cicero's translation uses the same method. Green has made the important observation, however, that Cicero takes his astrometeorology beyond that of Aratus.[85] For example, Capricorn is associated with cold weather (*Arat.* fr. 33.57-9), and Cancer is credited with accompanying hot weather (*Arat.* fr. 33.320). Both these are additions to Aratus' astrometeorology, the constellations for which are listed above.[86] This suggests that there was an interest in astrometeorology beyond simply that which was included in Aratus' work, which in turn may hint that there had been some degree of development in astrometeorological theory, which had firmly taken root in Rome. Such development is also attested in the Clodius Tuscus parapegma, which is vastly more detailed astrometeorologically than anything extant dating before it.[87]

The so-called 'Quintus Cicero fragment', 20 lines of poetry preserved in Ausonius' *Eclogues* in which its authorship is attested as Quintus Cicero, Marcus' brother, is our second example. It is quoted here in full:

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[84] It is generally agreed that the translation of the astronomical section of Aratus' *Phaenomena* by Cicero took place in 89-86 BC, but whether it then underwent a revision later, when a *Prognostica* is referred to in 60BC, is unknown. For discussion see Soubiran (1972) 8-9, Gee (2001) 520, who also discusses the dating of the *Prognostica* more generally, for further on which see p134 n.75 above.
[85] Green (forthcoming, 2014).
[86] On p.40.
[87] For details of this, see p. 147-8.

Quinti Ciceronis hi versus eo pertinent ut quod signum quo tempore inlustre sit noverimus; quod superius quoque nostris versibus expeditur:

flumina verna cient obscuro lumine Pisces
curriculumque Aries aequat noctisque dieique,
cornua quem condunt florum praenuntia Tauri.
***arida**que aestatis Gemini primordia pandunt*
longaque iam minuit praeclarus lumina Cancer
*languificosque Leo proflat ferus ore **calores**.*
*post modium quatiens Virgo **fugat** orta **vaporem**,*
autumni reserat portas aequatque diurna
tempora nocturnis dispenso sidere Libra,
ecfetos ramos denudat flamma Nepai.
*pigra Sagittipotens iaculatur **frigora** terris,*
***bruma gelu glacians** iubar it **spirans** Capricorni,*
*quem sequitur nebulas rorans **liquor** altus Aquari.*
tanta supra circaque vigent †umi† lumina mundi.
at dextra laevaque ciet rota fulgida Solis
mobile curriculum et Lunae simulacra feruntur
* * * * * * * * * * *
squama sub aeterno conspectu torta Draconis
eminet. hunc infra fulgentes Arcera septem
magna quatit stellas, quam servans serus in alta
conditur Oceani ripa cum luce Bootes.

"These lines of Quintus Cicero tell us which star-sign is shining at which season; as has already been expounded previously in my poetry:

The Fish summon the spring rivers with their dim light;
Aries make equal the course of night and day;
He is hidden by Taurus' horns, harbingers of flowers.
The Twins open the **dry** beginning of summer,
Next illustrious Cancer shortens the long days,
And fierce Leo breathes out from his mouth enervating **heat**.
Then Virgo rises, and, shaking her measuring-vessel, puts the **heat to flight**.
Libra with equally balanced star unlocks the gates of autumn,
Making the hours of day equal to those of night.
The fire of Scorpio strips the spent branches.
The Archer shoots numbing **cold** to earth.
Winter, turning **rigid with frost**, come, the **windy** star of Capricorn;
Following him on high, the **moist** constellation of Aquarius bedews the clouds.
These are the great lights of heaven, which hurry in their circular paths above.
But on the right hand and on the left
The bright wheel of the sun drives on its rapid chariot,
And the moon, its reflection, is carried along.
* * * * * * * * * * *
Draco raises up his scaly coil in constant view;
Below him, the great Wagon shakes its seven shining stars;

Guarding it, Bootes at dawn is hidden late in the deep River of Ocean."[88]

The date of this text is highly questionable. Mark Possanza, following Ausonius' attribution of Quintus as author, puts it at 45-43 BC[89] but Emma Gee has argued that we should not discount the possibility of it either being part of Marcus Cicero's translations of Aratus (and thus dating from around the 80s BC),[90] or even a 4th century AD fabrication.[91] Analysing the meteorology in the passage does not get us any closer to a date but does, to me at least, suggest that it was not part of Marcus' translation.

In the above text, words or phrases that we can read as having meteorological significance have been placed in bold type. The author uses characteristics of the seasons associated with specific constellations to link them closely to the weather; as Gee says, the poem "represent[s] weather in pictorial form."[92] This is done by giving meteorological significance to the period during which the sun is passing through a specific zodiacal constellation, a factor I think Gee has overlooked. The description of Libra makes this clear:

> *autumni reserat portas aequatque diurna*
> *tempora nocturnis dispenso sidere Libra,*
>
> "And Libra, with her regulated star, opens the gates of autumn
> and makes the length of day and night equal."

The significance of Libra is characterised by a very important astronomical event here, the autumnal equinox. That this occurs when the sun first enters the sign of Libra is confirmed in the Geminus parapegma:

> ἐν μὲν οὖν τῇ α' ἡμέρᾳ Εὐκτήμονι ἰσημερία μετοπωρινή· καὶ ἐπισημαίνει. Καλλίππῳ ὁ Κριὸς ἄρχεται δύνειν· ἰσημερία μετοπωρινή.
>
> "On the 1st day [of the sun entering Libra]: According to Eutemon the autumn equinox, and there is a change in the weather. According to Callippus, Aries begins to set, autumnal equinox."

To describe Libra as signifying the autumn equinox, then, the fragment must be referring to the sun passage and not to, for example, the annual risings of the constellations themselves. So the fragment tells us that the time of Gemini accompanies the dry start of summer, Leo brings heat, Virgo removes it, Sagittarius sees the arrival of cold, which is worsened under Capricorn, and Aquarius brings about the end of

[88] Gee's (2007) translation.
[89] Possanza (2004) 45ff.
[90] Gee (2007) 580-1.
[91] Gee (2007) 583.
[92] Gee (2007) 567.

winter and beginning of spring. Thus the astrometeorology of this fragment is different in form from that of Aratus' *Phaenomena* and thus the extant remains of Marcus' translation. It is this that makes me suspicious of linking it with the translation. Importantly, however, it is a form that the Geminus parapegma attests to and, as we will see later, is exploited elsewhere by Romans contemplating the weather.[93]

The two Ciceronian pieces thus make it clear that astrometeorology, potentially in two differing forms, was present in Rome in the first half of the 1st century BC. It is with this impression of weather prediction, presenting at least a degree of utility of both astrometeorological and weather signs, that I now want to move to other chronological extreme of this chapter, towards the end of the first century AD.

Pliny and Columella

Pliny's weather sign list of *NH* 18.340-365 represents, I believe, a fundamental shift in the status of weather signs in antiquity. Hitherto, I have argued, weather sign lists were organised in such a way as to present a model of use in conjunction with astrometeorology. To achieve this mode of operation, weather signs were grouped by weather type. Pliny's organisation, however, is by sign source. His description in the summarium of book 1 of the list reveals this:

> *(lxxviii-xc) Prognostica: a sole, a luna, stellis, tonitribus, nubibus, ignibus terrestribus, aquis; ab ipsis tempestatibus; ab animalibus aquatilibus, a volucribus, a quadrupedibus.*
>
> "([book 18, chapters] lxxviii-xc) Weather signs: from the sun, the moon, stars, thunder-clouds, mists. Earth-fires, waters; from the seasons themselves; from aquatic animals, from birds, from quadrupeds."

How would a list organised in this fashion be used, if one wanted to make a prediction from weather signs? This, I think, is where Sider and Brunschön's sign to text model of operation can once again be considered. To recap, Sider and Brunschön argued that to use weather sign lists for the purposes of making predictions, one observes a particular sign and then looks it up in a handbook or other similar source. They argue that practical lists are therefore organised by sign type, to allow the easy location of particular signs e.g. a wolf would feature in a section of signs taken from animals. By their argument, this would make Pliny's list a practical one and, indeed, they argue this,

[93] See pp.154-161.

stating that "Pliny's arrangement is orderly and more practical than that of the *DS*".[94] In the previous chapter, I raised serious concerns about this as a model for applying to weather sign lists, in that one is required to know what are significant signs, and what are not, before consulting a reference work. In addition to this, one would need to carry around lists of weather signs at all times, which is itself not a convenient thing to do, and something for which we have no evidence whatsoever. I would suggest, then, that Pliny's weather sign section represents not a 'more practical' list, but actually one in which the practicalities of predicting using weather signs was a very insignificant factor in its organisation. Instead, I will argue here that the organisation and grouping of Pliny's weather signs was designed to bring the list in to line with the structure of the *Natural History* as a whole. I will also suggest that it is probable that Pliny was constructing his list of weather signs from a list that was structured according to the 'weather type' system of organisation. It is with this point I will start.

Pliny makes it clear that for the placement of his first three groups, he is following a standardised pattern. He introduces each section as follows:

Sun (18.341):
…***primum****que a sole capiemus praesagia.*

"…**first** we will take weather forecasts derived from the sun."

Moon (18.347):
Proxima *sint iure lunae praesagia.*

"**Next** must rightfully come the prognostics from the moon."

Stars (18.351):
Tertio loco *stellarum observationem esse oportet.*

"**In the third** place must come the observation of the stars."

Pliny is clearly following a thought-through order here. The 'first… next… third' notation that we see here demonstrates that Pliny is paying particular attention to the ordering of these first three groups. There can be no doubt that the Sun group must come first, and the star group third; they have specific positions within the list. The Moon has a generic 'ordering word', *proxima*, but since this section is flanked by the sun and stars, its position too is clearly deliberate. Pliny places these 'ordering words' so that they are the first word introducing each section,[95] making his pattern as much his

[94] Sider and Brunschön (2007) 24-5.
[95] The sun introduction is set within a more general introduction to the weather signs, but the clause quoted is the only clause that introduces the sun signs specifically.

focus as the signs themselves. This neat arrangement, however, is broken with the group that of follows the stars, the thunder section. This section is not introduced at all, but begins simply with its first sign,[96] a fact that is also true of the section on clouds.[97] The numbering system operating at the start of the list is thus quickly abandoned, denoting the first three groups as somehow special. The other sections do feature introductory remarks, but none of these have the same sense of deliberate ordering that appears in the sun, moon and stars sections.[98]

What makes it clear that Pliny is following a pre-existing system of ordering is his use of the word *iure*, translated as 'rightfully' above. Pliny is telling us that there is some reason that the signs from the Moon come in this secondary position. But what is this? As we have seen, the positions of the first three groups of signs are picked out for special attention. Since the Moon comes second of these three, and its position is seen to be the correct one for it, I think we can fairly safely extend the idea of 'rightful' placement out to the Sun and the stars. Following from this, I would suggest that by *iure*, Pliny is referring to the standardised pattern of weather sign lists that I have argued was developed by the Greeks and adopted by the Romans, which involves treating signs from the Sun, Moon and stars differently to other signs because of the way the lists were used. This 'right' pattern, however, need only apply to weather sign lists that are organised by weather type, and are therefore used (or theoretically used) by applying my 'text-to-sign' operation model – for example the *De Signis*, the *Phaenomena* and the *Georgics*. There is no practical need for Pliny to place these things first in the way he does. The fact that Pliny does follow this custom makes it highly probable, I believe, that he is constructing his list of weather signs from sources lists that are organised by weather type. The fact that Pliny's potential weather sign sources for this section are cited as Vergil, Theophrastus (if we take this to mean the *De Signis*), Aratus, and Democritus and Varro are cited in the text itself, and that of those identifiable texts, Vergil, Aratus and 'Theophrastus' organise by weather type strengthens my suggestion.

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[96] (18.354) *cum aestate vehementius tonuit quam fulsit, ventos ex ea parte denuntiat, contra si minus tonuit, imbrem-* "A thunderstorm in summer with more violent thunder than lightning foretells wind in that quarter, but one with less thunder than lightening is a sign of rain".

[97] (18.355-357) - *nubes cum sereno in caelum ferentur, ex quacumque parte id fiet venti expectentur-* "When clouds sweep over the sky in fine weather, wind is to be expected in whichever quarter the clouds come from".

[98] The section on fire signs is the only other section to feature an 'ordering word': (18.357) *ab his terreni ignes proxime significant* – "After these, signs from fires of earth are given next". By this point, however, the sense of ordering has, as I noted above, been broken by the thunder and cloud sections, and the *proxime* is not placed at the start of the introduction. The other groups are introduced without ordering words, but just a comment on the sign source. For example the section on aquatic animals is introduced (18.361) simply with: *praesagiunt et animalia* – "presages are also given by animals".

Pliny, then, appears to have rearranged a practical 'text-to-sign' organisation into one that is, I have suggested, really quite impractical for the purpose of prediction, 'sign-to-text' organisation. This rearrangement may well indicate that Pliny had no intention of his weather sign list being used for regular forecasting; a point to which I will return shortly.

That practical matters were not at the forefront of Pliny's mind when writing his list is also demonstrated by the fact that his list appears to be constructed in order for the groupings to parallel the groupings found more widely in the *Natural History*. As Sider and Brunschön have noted, Pliny's summary of the contents of his weather sign list, quoted above, is a broadly accurate one. The only slight error is that in the section that he claims has signs from the seasons, there are also a number of other, miscellaneous signs.[99] Let us, then, consider the structure of Pliny's list.

As I have discussed above, Pliny's list begins with signs from the sun, moon and stars. While I am convinced that in doing this, Pliny is following the conventions of weather sign lists that have been discussed above, both in this and the previous chapter, it does have the additional convenient characteristic of beginning just as Pliny's whole work does; with matters celestial. The structure of the *Natural History* as a whole has been summarised by Mary Beagon:

"The structure of his inquiries is dictated by that of the natural world as viewed by man, starting with the cosmos as a whole…and progressing through all its subdivisions, animals, vegetable, and finally mineral."[100]

Pliny's encyclopaedia is therefore essentially a 'top-down' study of the world, beginning at the highest possible point, and progressing downward from there. We can, I think, see his weather sign list doing a similar thing. It begins with the celestial phenomena, descends down through the clouds and weather, reaches earth, then water, before dealing with animals and birds. This pattern, however, is only a very broad one and does not directly map on to the order of the books and chapters of *Natural History*. Some of the categories in which he chooses to assemble his signs, however, do give an indication that he is grouping them so that they agree with other groupings present in the *Natural History*. In particular, how he organises signs from animals is, I think, particularly telling.

[99] See Sider and Brunschön (2007) 35
[100] Beagon (1992) 13.

Animal groups make up the final three categories of Pliny's weather sign section. He groups together signs from aquatic animals, *ab animalibus aquatilibus*, birds, *a volucribus*, and quadrupeds, *a quadrupedibus*. We have no precedent within weather sign literature for grouping in this way, but I think we can see the reason for it by looking elsewhere in the *Natural History*. If we do this, we find that book nine is devoted to, as the contents in book one tells us, *aquatilium natura*, 'the nature of aquatic animals', and book ten to *volucrum naturae*, the nature of birds. Two categories of weather sign are thus found elsewhere. Book eight is devoted to terrestrial animals (*ad reliqua transeamus animalia et primum terrestria* – 'let us pass to the rest of the animals, and first those that live on land'). Initially, this would seem to undermine a comparison between the book and weather sign groupings, since Pliny's third category of weather sign animal is actually quadrupeds. Looking within book eight, however, reveals that Pliny evidently views quadrupeds to be a sub-category of animal. We can see this in, for example, his comments on panthers:

> *Pantheris in candido breves macularum oculi. Ferunt odore earum mire sollicitari quadripedes cuntas, sed capitis torvitate terreri;*
>
> "Panthers have small spots like eyes on a light background. It is said that all quadrupeds are amazingly attracted by their smell, but frightened by the savageness of the head."
>
> - *NH*.8.62

Here Pliny makes a comment relevant to all quadrupeds. He is obviously happy, therefore, for this to be a grouping of animals in itself. Thus it looks strikingly as though in the organisation of his weather signs, Pliny has chosen to group them in a way that makes them tally with other categories within the *Natural History*. His grouping can therefore be viewed as a hybrid of conventional weather sign organisation (in play at the beginning of his list), and his own grouping priorities (at the end). The fact that he employs this hybrid, with some of the categories being born out of the structure of the wider work, does suggest that the importance of the list being unified with the *Natural History* as a whole was the most significant organisational factor in this list, and practicality was therefore not a primary consideration.

What, then, can this tell us about weather signs in this period? The 'sign to text' model that Sider and Brunschön would like to see applied to the *Natural History* list is simply not practical for day-to-day prediction of the weather. Pliny's list, however, is evidently unusable if one tries to apply the 'text to sign' model I have argued should be

applied to the *De Signis* in order to make predictions. Pliny's weather sign list, I would therefore suggest, is actually representative of the fact that weather signs were not viewed as a genuinely useful way to predict the weather when Pliny wrote his *Natural History*. Instead, they had become casual supplements to what is depicted as a main system of prediction (that is, astrometeorology), and are perhaps presented as being more akin to the *mirabilia* that litter the *Natural History*[101] than to a practical, everyday forecasting method. If one wished to use Pliny's list of weather signs, a combination of both modes of operation was probably needed – one might glance at the list, remember a few signs and apply them if the opportunity arose (applying a text to sign model), or maybe observe a sign and consult the text if proximity and time allowed (a less formalised version of the sign to text model). Rather like, therefore, how one might use such a written list today. Neither of these methods, however, are serious ways of making regular, frequent predictions in everyday life.

We have, then, seen here, between Cicero (and perhaps Varro) and Pliny, a change in the presentation of weather signs. At first, I demonstrated, they were portrayed as broadly reliable predictors, capable of, for example, keeping a ship's captain from trouble. By the time Pliny was writing, however, weather signs had been relegated to much more consciously impractical chunks of knowledge.

We can contrast Pliny's weather signs with his astrometeorology, which is woven into an agricultural calendar. His calendar is divided into broadly seasonal, or part-seasonal entries that typically include a section which describes significant movements of constellations for that period of time, together with their corresponding Julian dates and weather predictions. An example from the entry for early spring reads as follows:

> *Caesari VI idus significatur imber librae occasu. XIV kal. Mai. Aegypto suculae occidunt vesperi, sidus vehemens et terra marique turbidum; XVI Atticae, XV Caesari continuo quatriduo significant, Assyriae autem XII kal…*
>
> "According to Caesar, the setting of the Scales on April 8 indicates rain. In the evening the Little Pigs, a stormy constellation bringing boisterous weather on land and sea, sets for Egypt on April 18; it sets on April 16 for Attica and April 17 according to Caesar, indicating four successive days of this weather, but on the 20th for Assyria…"
>
> - *NH.*18.247

[101] The fullest study of *mirabilia* in the *Natural History* is that of Naas (2002) 243 – 393, but they also feature heavily in Beagon (1992), especially 8-11, and are discussed in the wider context of Roman knowledge in Naas (2011). It is interesting to note that weather signs find a place in the *mirabilia* literature of the 'Second Sophistic', specifically in Aelian's *On Animals* 7.7-8.

This is then followed by a section that describes the farm work needing to be done during that period, as well as pieces of other connected information, such as descriptions of the activities of animals (see the glow worm description of 18.250-3), details of equipment (e.g. different types of scythe at 18.261-2), further comments on the expected weather (18.231), and general advice on the cultivation of meadows (18.258-60). The early spring entry can again provide us a good illustration of this section:

> *Ergo opera: taleas olivarum ponere ipsasque oleas interradere, rigare prata aequinoctii diebus primis, cum herba creverit in festucam, arcere aquas, vineam pampinare … segetes iterare. saritur diebus XX. ab aequinoctio sartura nocere et vineae et segeti existimatur. et oves lavandi hoc idem tempus est.*
>
> "So, the things to be done: to plant olive-cuttings and rake over between the olive trees themselves; in the first days of the equinox to irrigate the meadows; when the grass has grown to a stalk, to shut off the water; to trim the vine…to plough over the corn crops again (hoeing takes 20 days). It is held that to start hoeing at the equinox injures both vines and corn. This is also the time for washing sheep".
>
> - *NH.*18.254

Just as we saw with earlier agricultural sources, the time of the year, the weather, and the tasks that must be completed are all closely knitted together here to provide advice. That a farmer's work is governed by the weather is a fact that it not only recognised in Roman agricultural writing,[102] but is self-evident. By linking the weather of a season to the work, Pliny, in his calendar, therefore presents astrometeorology in its applied, practical form, mirroring the chronologically progressing structure of an inscriptional parapegma. It is thus organised as a method capable of, and suitable for, everyday prediction in a circumstance in which knowing the weather is of crucial importance. This is starkly different from Pliny's presentation of weather signs, which are disembodied from the agricultural material, their use to farmers suggested only by their placement in book 18, the agriculture book, and, I have argued, reorganised without consideration for their use. As Murphy has shown, however, Pliny is a master of the digression and unexpected turn,[103] and it could therefore be argued that we should not anticipate that two topics would be treated in the same manner anyway. But, following that line of enquiry, we would be forced to ask why the astrometeorological material is

[102] See my comments on Cato above, pp.131-3.
[103] See Murphy (2004) 30-8.

preserved in its 'traditional' form and not broken up or reorganised. Pliny evidently felt that astrometeorological material was best presented in a directly practical context, whereas weather signs could be easily restructured. It would seem, therefore, that the relegation of weather signs from practical contexts coincided with a reinforcement of the practical applicability of astrometeorology.

That Pliny's presentation of astrometeorology was seen as a practical one, and that weather signs were being replaced by astrometeorology is reinforced by considering evidence from Columella's *De Re Rustica*, an agricultural guide from the mid-1st century AD. At book 11.32-101, Columella lists the farm work to be done throughout the year in the form of a parapegma. His parapegma correlates dates of the Julian Calendar with a series of astronomical observations, and the weather that can be expected. This is then used to inform decisions on what work is suitable to carry out, which feature in a section that follows the astronomical information. We can thus see that the format of the presentation of this material is virtually identical to Pliny's. So, an example for both sections, taken from the entry for February, reads as follows:

> "*Cal. Feb. Fidis incipit occidere, ventus Eurinus, et interdum Auster cum grandine est. III nonas Feb. Fidis tota, et Leo medius occidit. Corus aut Septentrio, nonnunquam Favonius…*
>
> *…Per hosce dies locis maritimis et calidis ac siccis prata vel arva purgantur, et in fenum submittuntur. Reliquae partes vinearum propter bruman vel frigora omissae, nunc palandae et alligandae sunt, ne postea tumentes gemmae laedantur et oculi atterantur…"*
>
> "On February 1st the Lyre begins to set; the wind is from the east, and sometimes from the south, with hail. On February 3rd the whole of the Lyre and half of the Lion set: the wind is in the North-west or North and sometimes in the West…
>
> …During these days in places near the sea and which are warm and dry, the meadows and cornfields are cleansed and covered under hay. The remaining portions of the vineyards, which were passed by on account of the winter and the cold, must now be supported and tied up, so that later the swelling buds may not be damaged and the 'eyes' rubbed off…"
>
> - *Rust.* 11.ii.14; 15

It is sufficient for now to note the method used for his weather predictions; his forecasts are exclusively astrometeorological – at no point do weather signs feature in Columella's text. So it is that in the text quoted above, the risings and settings of the constellations the Lyre and the Lion are referred to. We must appreciate, however, that astrometeorology in this organised form was most likely not how it was used in rural

settings; it was "probably lifted out of Greek texts by Columella and the others rather than having been preserved on the lips of Roman farmers from the early Republic period on".[104] Instead, it presents us with an elite view of what farming is like, or, more specifically, how Columella thinks farming should be viewed, and what it should be like.[105] As such, that Columella favours astrometeorology over weather signs in his manual suggests that he viewed astrometeorology as being in some way a better method by which to predict the weather.

Indeed, we have other evidence that indicates that astrometeorology was used for predictions in this period. The Clodius Tuscus parapegma, for example. The Clodius Tuscus parapegma is a difficult text. It is preserved as a Greek translation in Lydus' sixth century *De Ostentis* and contains a number of features that are unique to it, and appear in no other extant parapegma.[106] Clodius Tuscus' dates are usually placed at 30 BC -15 AD,[107] and the inclusion of the month of August in this parapegma dates it to at least 8 BC. Regardless of its precise dating or authorship, however, it contains enough content in common with Columella's parapegma and Ovid's *Fasti*[108] to be useful to us here as source for the astrometeorology of this period. The form of the parapegma, with information organised according to a series of dates, was certainly familiar by this period, as evidence from the letters of Cicero demonstrates.[109] Typical entries from the Clodius Tuscus parapegma appear as follows:

> Μάιος
>
> α'. καλένδαις Μαίαις ὁ μὲν Κύων κρύπτεται, δρόσος δὲ καταφέρεται.
> β'. τῇ πρὸ ς' νωνῶν ἡ Ὑὰς μετὰ τοῦ ἡλίου ἀνίσχει.
> γ'. τῇ πρὸ ε' νωνῶν ὁ Κένταυρος ὅλος φαίνεται καὶ ζέφυρος πνεῖ.
> Etc…
>
> "May
>
> 1. On the Kalends of May: Sirius disappears, and dew settles.
> 2. On the 6th day before the Nones: the Hyades rise with the sun.

[104] Lehoux (2007) 80. Constructions of rural calendars by elite Romans will be discussed in more detail later.
[105] That Columella is attempting to reverse the prevailing negative view of agriculture amongst elite Romans will be demonstrated later, see pp.194-8.
[106] For details see Lehoux (2007)162-3.
[107] See Keyser (2008).
[108] As observed by Keyser (2008).
[109] See Cic.*Ad Att.* V.14 – *ex ea die, si me amas,* παράπηγμα ἐνιαύσιον *commoveto,* "from this day, if you love me, move the yearly parapegma" – with Lehoux (2007) 200-1.

3. On the 5th day before the Nones: the whole of Centuarus appears and the west wind blows."[110]

Etc…

As the above passage demonstrates, in this parapegma, Julian dates form the basic organisational backbone, according to which star movements and predictions of the weather are given. Unlike Columella's or Pliny's agricultural calendar, here the astrometeorology stands alone, unconnected to specific tasks. It reflects, though, the interest in astrometeorology; it allows the weather to be predicted. The Clodius Tuscus parapegma demonstrates that astrometeorology was of interest outside the realm of the explicitly agricultural, and was therefore of interest as a predictive method in itself. We can contrast the existence of this text with the absence of a Roman equivalent to the *De Signis*; there is no Roman text that is consciously concerned with the question of practicality, and that is devoted to the use of weather signs.

The Clodius Tuscus parapegma also allows us to see the extent of the development in astrometeorology. In the Geminus parapegma, discussed in detail in the previous chapter, of the 365 days of the year, 127 have entries, of which 93 are explicitly meteorology. According to that parapegma, then, just over 25% of the days of the year have a predictable weather change. By the time the Clodius Tuscus was written, every single day of the year has an entry detailing its astronomical particulars. Of these, 299 also include meteorological information meaning that 82% of the days of the year have predictions attached to them. The difference in the number of predictions provided by these parapegmata is startling, demonstrating over a three-fold increase. Evidently astrometeorology developed significantly in the period between the writing of these two parapegmata: interest in the method was obviously great. This reinforces the idea that the 1st centuries BC and AD saw the increasing perception of astrometeorology as a significant, substantial prediction method and with this, the possibility of the reduction in extent to which weather signs are treated as useful predictors. With this movement comes an inevitable widening of the divide between the methods, the exploration of which can provide some useful insights into how they are shown to relate to one another.

[110] Lehoux's (2007) translation: pp.357-375. Text from Wachsmuth (1897) p.132, lines 14-16 & p.133, lines 1-2.

Dividing the Methods

I stated above that Columella must have viewed astrometeorology as a better method of prediction for inclusion in his text than using signs. This was based on an absence of weather signs in his work. I demonstrated in the previous chapter, however, that astrometeorological sources, and in particular literary and inscriptional parapegmata, usually do not make any reference to weather signs and their absence from Columella's treatise may not seem, therefore, all that surprising. To strengthen the assertion that astrometeorology was favoured over weather signs, it is therefore necessary to demonstrate that some kind of selection process was carried out by Columella. We can do this by looking at his influences for the astrometeorological section. Here, we can see that his use of astrometeorology actually results in an active suppression of weather signs.

Columella's work is a highly 'literary' piece of Latin prose. Its twelve books contain some fifty quotations from Vergil's *Georgics*[111] and in the course of book 10, prose gives way altogether to a 436 line hexameter poem, usually referred to as 'Columella's Garden'. It is thus not surprising to find that Vergil is the inspiration for the parapegma of book 11; Columella cites the *Georgics* as an example of where the importance of star-observation to the farmer is stressed:

> *Quare necessaria est menstrui cuiusque officii monito ea, quae pendet ex ratione siderum et caeli. Nam ut ait Vergilius,*
>
> *Tam sunt Arcturi sidera nobis*
> *Haedorumque dies servandi et lucidus anguis,*
> *Quam quibus in patriam ventosa per aequora vectis*
> *Pontus et ostriferi fauces tentantur Abydi.* [*Georgics* 1.204-7]
>
> "Therefore there are necessary duties of each month I warn you of, which depend on a consideration of the stars and sky. For as Vergil says:
>
> We must watch Arcturus' star,
> the days of the Kids and the gleaming Snake
> just as those who, sailing homewards over the windy sea,
> risk the Pontus and oyster-breeding Abydos' narrow jaws."
>
> - *Rust.* XI.i.30-1

[111] Columella's use of Vergil has recently received a small flurry of attention; Doody (2007), which sees Columella's use of Vergil as an attempt to root the *De Re Rustica* in a tradition of Roman agricultural writing; Dumont (2008), which assess Columella's technical use of Vergil; Cowen (2009), in which Columella's echoing of Vergil's cucumber/snake description is detailed.

What is striking about Columella's use of Vergil, though, is that Vergil discusses the movement of the stars only in a few brief passages that deal with time-reckoning and does not link them to detailed weather predictions.[112] Instead, Vergil deals with weather prediction primarily in his longer passage of weather signs. Such signs are absent from the *De Re Rustica* and it would therefore appear that Columella, rather than producing an extended passage on weather signs, focussed instead on the shorter passage on astral movement and extrapolated this into the basis on which to include an astrometeorological parapegma. As Dumont has shown,[113] we should not expect Columella to imitate the details of Vergil's poem, its influence tending to be more descriptive than technical, but the complete absence of weather signs from Columella's text, and having read the *Georgics* he would have clearly been aware of them, suggests a clear decision has been made about the method of weather prediction that is to be included in his handbook; he has very deliberately excluded prognostic weather signs and included astrometeorology. Below, I will suggest reasons for this.

This casts the relationship between the two predictive methods in rather a different light. Rather than having the two systems appearing as complementarily to one another, as the *De Signis* list seemed to, it is now the case that a decision needs to be made between weather signs and astrometeorology; the methods are seen to be so different, that it is troublesome to include both.

The fact that Pliny's treatment of the two methods is so different supports this idea. They are presented as entirely independent systems, their only point of contact being that they are both trying to predict the weather. This dichotomisation of the methods can also be seen in literary representations of weather prediction. In the previous chapter, I argued that characters in Greek poetry could be associated with rurality by making them predict the weather. The mode of prediction, however, was typically irrelevant, with characters often being credited with awareness of both weather signs and astrometeorology. Lucan's *Pharsalia* demonstrates a change from this position, as we find a character predicting by weather signs alone. At the same time, the absence of astrometeorology is, I believe, deliberately highlighted.

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[112] *G.*1.64-5 notes that fields should be lightly ploughed as Arcturus rises. *G.*1.204-58 describes when to plough and when to sow, according to the seasons. To distinguish these different periods, the risings and settings of the stars are used. As 1.252-3 acknowledges, these tasks are connected to the weather, but these are only broad seasonal patterns and do not go beyond telling us that winter is cold and wet. 1.351-463, however, lists about 65 signs for four weather types.

[113] Dumont (2008) 49-53.

The section of the poem from book 5 describes Caesar's attempt to cross the sea from Dyrrachium to Italy to meet Anthony in battle. To make the crossing, Caesar is forced to use the boat of a local fisherman, Amyclas. Amyclas, reading a series of weather signs, predicts tempestuous weather and difficult sailing. He is correct, and during Caesar's journey, a great storm hits, which almost thwarts the crossing. Caesar, however, makes it safely to Italy.

To make his prediction, Amyclas relies solely on weather signs – no mention of astrometeorology is ever made. That this fact is central to the characterisation of Amyclas in the poem I will argue later. For now I will argue that the absence of astrometeorology is deliberately highlighted in this passage to emphasise the method Amyclas is using to make his forecast. This is primarily done by stressing when Amyclas makes his prediction, and by making reference to the visibility of the stars.

Amyclas' prediction explicitly takes place at night. When Caesar first sets out from his camp to find a boat, the scene is set with the following lines:

> *Solverat armorum fessas nox languida curas,*
> *parva quies miseris, in quorum pectora somno*
> *dat vires fortuna minor…*
>
> "Drowsy night had relaxed the weary cares of war, a short break for the unhappy men in whose breasts their lesser fortune gives strength in sleep…"
> - Luc. 5.504-6

There can be little doubt that what is happening is taking place at night. Not only is it explicitly mentioned, *nox*, but its effect on men, sleep, is brought firmly into focus. When Amyclas begins to give his reading of the natural signs, he himself starts by referring to the time:

> *Multa quidem prohibent nocturne credere ponto.*
>
> "A great many signs prevent me trusting the sea tonight"
> - Luc.5.540

Here again, we see the time explicitly mentioned. Amyclas does not trust the signs *nocturne*, 'by night'. Further to this, the signs themselves appear to have been chosen to focus our attention on the fact that night has recently arrived. As I demonstrated above, Lucan follows the conventional organisation of weather sign lists, and it appears that within that structure, he has selected very specific signs. So, as one would expect, he begins with signs from the Sun:

Multa quidem prohibent nocturne credere ponto;
*nam sol non rutilas **deduxit** in aequora nubes*
concordesque tulit radios: Noton altera Phoebi,
altera pars Borean diducta luce vocabat.
*orbe quoque exhaustus medio languensque **recessit***
spectantes oculus infirmo lumnie passus.

"A great many signs prevent me trusting the sea tonight; the sun did not **draw down** reddened clouds into the waters or display its agreeable rays; with its light divided, one part of Phoebus summoned Notus, the other Boreas. And he **vanished**, hollowed out and faint in the middle of his orb, with a feeble light allowing gazing eyes."

- Luc.5.540-2

These are not, however, just any, randomly selected Sun signs. They are specifically signs from a setting Sun. So we are told that the Sun did not 'carry down', *deduxit,* clouds, and its centre has hollow as it set, *recessit*. Since the Sun has set, our current time must be during the night. Following the convention, Lucan then moves on to give signs from the Moon. These too, however, are carefully depicted:

*Lunaque non gracili **surrexit** lucida cornu*
aut orbis medii puros exesa recessus,,
ventorumque notam rubit; tum lurida pallens
ora tulit voltu sub nubem tristis ituro.

"And the moon did not **rise** bright with a slender crescent, or with the middle of her orb hollowed out into a clear recess, but she reddened with the sign of winds; then, pale, she showed her weakened face, and her gloomy image passed behind a cloud."

- Luc.5.546-550

In this passage, the focus is put on the fact that the signs are taken from the Moon when it has risen, *surrexit*. This is surely obvious; one cannot observe the Moon unless it has risen. Why, then, mention this? It does, I think, once again focus our attention on the fact that the events of the narrative are taking place at night. We have had our attention specifically drawn to the fact that the Sun has set, and the Moon has risen. We must, then, be in night.

Lucan emphasises the time of night, I believe, to make sure we have noticed that Amyclas is not using astrometeorology. Astronomy and observation of the stars do, after all, appear elsewhere in the *Pharsalia.*[114] Being so clearly night, why, we must wonder, has Amyclas not looked up to the heavens, observed the constellations and

[114] On these, see the astronomical appendix in Housman's edition of Lucan, (1926) 322-37 and Grimal (2010) 66-8.

made a prediction based on astrometeorological patterns? The appropriateness of this question is reinforced once Amyclas has finished speaking, where the effects of the coming winds are described:

> *Haec fatur solvensque ratem dat carbasa ventis,*
> *ad quorum motus non solum lapsa per altum*
> *aera disperses traxere cadentia sulcos*
> *sidera, sed summis etiam quae fixa tenetur*
> *astra polis sunt visa quati…*
>
> "He said these words, and untying his boat, released the sails to the wind; at their movement not only did the falling stars which glide through lofty air trace scattered trails, but even the stars which remain fixed in highest skies seemed to shake…"
>
> - Luc.5.561-4

To describe the winds, Lucan chooses first to focus on their effect on the stars.[115] The stars are therefore brought firmly into the foreground. This serves to highlight their absence from the preceding predictions, and thus emphasise the fact that Amyclas appears to be credited with no astronomical knowledge. This is true to such an extent, in fact, that not only does Amyclas not apply astrometeorology to make his predictions, but he also includes no astral weather lore. As I discussed above, it is common to follow weather signs on the Sun and Moon with those associated with the stars, for instance the Manger.[116] This is not included in Amyclas' speech. It would appear, then, that Lucan's poem provides firm evidence for the extent of the division between weather signs and astrometeorology. He makes Amyclas just use one method to predict the weather, and goes out of his way to ensure that his audience has noticed this fact. It is therefore made clear to us that Amyclas is definitely not using astrometeorology.

In this section we have seen a major shift in how weather signs are treated and in their relation to astrometeorology. The changing attitude to them witnessed between Cicero's mostly trusting account of their use, and Pliny's presentation of them, devoid of practical considerations, along with Columella's suppression of them, demonstrates a growing reluctance to present them as a serious way of making predictions of the weather. They are reduced to a heavily marginalised role in these texts, or else excluded all together. In contrast, astrometeorology is dealt with as a fundamentally practical method of prediction and there is evidence that it has undergone significant

[115] Thus the stars are not actually weather signs themselves, as Thompson & Bruère (2010) 135 suggest they are.
[116] The visibility of the Manger as a weather sign has been discussed above *passim*, but especially p.48 and 52.

development over time. Running parallel to this narrative is the increased division between weather signs and astrometeorology. That the relationship between the two methods became so firmly dichotomised and that, in some circumstances, they became viewed as almost opposite to one another and the inclusion of one is being done at the conscious expense of the other, introduces the possibility that the reduction in the use of weather signs did not just coincide with a rise in the use of astrometeorology, but that is was actually caused by it.

Before turning to consider the reasons why this relationship developed, it is important to briefly consider a piece of additional evidence that supports the narrative I have developed here, but about which I also wish to pose some questions.

The Meteorology and Date of Germanicus' Aratea

The *Aratea* attributed to Germanicus comes to us in six fragments.[117] The first, longest fragment of 725 lines is a rendering of lines 1-731 of Aratus' *Phaenomena*.[118] Fragment ii describes the movement of the sun, moon, and planets, and their relative orbital periods. Fragments iii and iv, which, being continuous, together total 191 lines, are meteorological and provide weather predictions based on the movement of planets through the zodiac. Fragment v describes the division of the terrestrial and celestial spheres into sections, and fragment vi, just one and a half lines long, appears to refer to the use of Greek vocabulary in Latin writing, specifically the name for the constellation Delta/Triangulum. My immediate interest in this text is with the meteorological fragments, iii and iv. It is important to stress here that both the author and date of this text are in constant scholarly debate. Most scholars, taking the author to indeed be Germanicus, the adopted son of Tiberius, typically give a date range of between 4-16 AD.[119]

The authenticity of fragments iii and iv is generally accepted by scholars but, as has often been noted, since they resemble nothing found in Aratus' work, their status and place within a larger work is unclear. As Gain argues, "whether they are based on another writer, or are a compilation of several sources, and whether there are original

[117] The fragment numbering is consistent across the two major editions of the text, those of Le Boeuffle (1975) and Gain (1976).
[118] For the changes made by Germanicus to Aratus' original in this extended fragment, see Gain (1976) and Possanza (2004).
[119] Gain (1976) 17, however, suggests that Tiberius himself may have been the author. Possanza (2004) Appendix A, pp.219-342 gives an overview of prominent positions, to which must now be added Green (forthcoming, 2014), who accepts the Germanicus attribution and early 1st century AD dating.

elements in them or not, is unknown".[120] Volk has more recently picked up this same thread of argument, and suggested that that they may be from a different work altogether, or that they may represent unedited 'scribblings' are also both possibilities.[121] What has been a particularly popular scholarly opinion, though, is the idea that the fragments do belong in some way with fragment i and are thus an 'updating' or 'reinterpretation' of Aratus' weather signs with some form of 'more scientific' astrometeorology.[122] This has never been explored beyond being a mere suggestion, however, and certainly, until this thesis, the relationship between weather signs and astrometeorology has not been investigated in sufficient detail to provide substantial support.

In many ways, simply accepting the prevailing scholarly opinion would make the Germanicus fragments fit elegantly into my thesis. I have argued that we do indeed see the favouring of astrometeorology over weather signs as a way to make predictions, especially after the mid-1st century BC and it could be argued that fragments iii and iv are representative products of this same overarching trend. The idea of 'replacement' thus gives further evidence of the growing divide between the methods. Similarly, I will continue to demonstrate that astrometeorology was viewed as being more firmly grounded in contemporary scientific theory and, more specifically, that weather signs were treated with suspicion due to the lack of explanations attached to them. Therefore, what has thus far only been a suggestion for why the Germanicus *Aratea* ends with an astronomical discipline rather than weather signs would be given much-needed strengthening evidence and context by this thesis.

However, the view that the meteorology of fragments iii and iv stands to replace the weather signs has been argued as such largely because it is taken to be simply 'astrometeorology'. This term has, I think, been applied so consistently to the Germanicus fragments, that the actual meteorology of the fragment has always assumed to be similar to other contemporary astrometeorological sources and has therefore never been considered in much detail at all. I wish to suggest here that, based on the meteorology of the fragments, a date within the 1st century AD may be less than secure, and that, in fact, they share common features with much later meteorological sources. Let us begin by considering the nature of Germanicus' prediction.

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[120] Gain (1976) 13.
[121] Volk (2009) 54.
[122] This can be found in Montanari Caldini (1973) 165ff, especially 200; Possanza (2004) 110; Volk (2009) 54; Green (forthcoming, 2014).

At fragment iii.1-24, general conditions associated with the zodiacal constellations are described. The following provides an example of this:

> *Virgo refer pluuias et permouet aera uentis.*
> *Ienius est Librae signuum; uix rorat in illo.*
> *Scorpios assidue caelo minitabitur ignis*
> *atque truces uentos…*
>
> "The Maiden returns water and stirs the air into activity with winds. The Balance is a gentle sign, scarcely even dew falls under it. The Scorpion continually threatens the sky with fire and fierce winds…"[123]
>
> - *Aratea* iii.10-14.

Although it is never formally spelt out, I think it is clear that the astrometeorology here employs the movement of the sun through the signs of the zodiac. This, I suggested above, is how the Quintus Cicero fragment's meteorology operates also. We see, therefore, parity in their predictions. Tabulated here for comparison are all the predictions from the Quintus Cicero fragment, and their equivalents in Germanicus fragment iii:

Quintus Cicero Prediction	**Line**	**Germanicus Prediction**	**Line**
Gemini: Dry weather	4	Gemini: Slight wind, generally dry	6-7
Leo: Heat	6	Leo: Dry heat	9
Virgo: Heat dispersed	7	Virgo: Wind and rain	10
Sagittarius: Cold	11	Sagittarius: Less rain	15
Capricorn: Cold and wind	12	Capricorn: Cold	16-17
Aquarius: Moist weather	13	Aquarius: Rain	18

Following this general account, we are told that the planets too have an influence:

> *haec ut quisque deus possedit numine signa*
> *adiungunt proprias uires.*
>
> "The god who occupies a particular sign at a particular time adds his own influence."
>
> - *Aratea* iii.23-4.

This is precisely what follows; a description of how the movement of the planets can be used to predict the weather. For example:

> *at modicus imbres, proni cum cornua Tauri*
> *frugiferamque Deam uel brumalem Capricornum*
> *attigerit, liquid non saeuus ad atherere fundet.*
> *inuectus Cancro, terras cum letifer ortu*
> *Sirius afflauit, nocituros temperat aestus.*

[123] Germanicus translations by Gain (1976).

Scorpios at rimans qua tollit acumina caudae
frigidaque extreme iam claudunt sidera Pisces,
Martia non illos turbabit stella neque imbre
aut ulla condet nitidos caligine soles.

"Nevertheless, he will not be harsh, but will pour forth from the gleaming sky only a moderate amount of rain, when he touches the horns of the Bull with head held low, the wheat bearing Goddess or wintry Capricorn. Carried into the Crab, he will moderate the baneful influence of Sirius' heat when Sirius at his rising breathes his deadly influence over the earth. When he is placed in the Scorpion, which lifts up the sting in its tail in its search for victims, or in the Fishes, which conclude the cold signs of winter, he does not disturb them, nor does he hide the sunlight of the sparkling days with showers or any obscuring medium."

- *Aratea* iv. 37-45

As this short excerpt, nine lines out of the 25 on Mars, demonstrates, the meteorology in the Germanicus fragments is based around the use of planets. As they move through their orbital path, entering and leaving the zodiacal constellations or a series of triangles composed of combinations of these constellations,[124] different kinds of weather can be expected. So, in the above passage, when Mars is in Taurus, Virgo or Capricorn, we should expect rain, when in Cancer, a slight cooling of the summer heat and when in Scorpio or Pisces, generally fine weather. Extant, we have predictive discussions of four planets: Saturn (iii.24-iv.24), Mars (iv.24-49), Venus (iv.50-109) and Mercury (iv.110-163). How does this compare to the 'astrometeorology' we have seen elsewhere?

Thus far in this thesis, we have seen two major types of astrometeorology. One uses the appearance and disappearance of particular constellations, stars or star groups to correlate weather to specific dates. We have seen this in the parapegmata of Columella, Pliny and Clodius Tuscus. The other type of astrometeorology we have seen is fundamentally zodiacal; it is concerned with the risings and settings of zodiacal constellations alone, the movement of the sun through the zodiac, or a combination of the two. These can be seen in the Geminus parapegma, the Quintus Cicero fragment and, as I will argue later, is represented in the Horologium Augusti. What is absent from all these, however, are the planets.[125] For example, planetary-meteorological material is

[124] For a discussion of the astrological ideas represented in the Germanicus fragments, see Montanari Caldini (1973). Green (forthcoming, 2014) discusses causality in this text.
[125] Interestingly, Mercury, or more specifically, the visibility of Mercury, has a long-attested history as a weather sign, outside of astrometeorology. See, for example, *De Signis* 46 – with Sider and Brunschön (2007) 200.

absent not only from Pliny's weather predictions in book 18, but also his extended account of the planets in book 2.[126]

To find the planets being used as weather predictors, we must look later, to Ptolemy's 2nd century astrological work, the *Tetrabiblos*. In book two of that work, weather prediction by the planets is discussed.[127] For comparison, let us look at what Ptolemy says about Mars:

> ὁ δὲ τοῦ Ἄρεως μόνος τὴν οἰκοδεσποτίαν λαβών...περὶ δὲ τὴν τοῦ ἀέρος κατάστασιν καύσωνας καὶ πνεύματα θερμὰ λοιμικὰ καὶ συντηκτικὰ κεραυνῶν τε ἀφέσεις καὶ πρηστήρων καὶ ἀνομβρίας·
>
> "Mars, when he assumes the rulership alone…With regard to the condition of the air he causes hot weather, warm, pestilential, and withering winds, the loosing of lightning and hurricanes, and drought."[128]
>
> - *Tetrabiblos* 2.8

This is the full entry connecting Mars, when in one of its house signs,[129] to the weather. The effect when Mars is elsewhere in the zodiac is not discussed. The meteorology of the Germanicus fragments iii and iv, by making use of the planets and the zodiac, resembles this Ptolemaic planetary prediction much more than it does astrometeorology we have seen elsewhere.[130] There is a scholarly trend to see it as a later development than other types of astrometeorology. Daryn Lehoux states that:

"There is also a later tradition, attested to in book II of Ptolemy's *Tetrabiblos*, for example, that looks at the positions and qualities of the planets as indicators of the weather. The cycles are considerably more complex than those of fixed-star astrometeorology, and are not tied to the seasons in the same way. *Tetrabiblos*-type astrometeorology is a distinct and later development to the fixed-star kind…"[131]

Lehoux, then, sees this planetary prediction as completely separate from other forms of astrometeorology. Otto Neugebauer's suggestion, however, is that using the planets to predict the weather is actually an extension of the astrometeorology which employs the position of the sun in the zodiac.[132] In both, however, planetary prediction is taken to

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[126] *NH* 2.59-84.
[127] Including a small number of weather signs. *Tetrabiblos* II.13 lists weather signs taken from atmospheric phenomena associated with the sun, moon and stars.
[128] Robbins' (1940) translation.
[129] 'Assuming rulership alone' refers to Mars being in one of its 'house' signs, Scorpio and Aries, at a time when no other planet is in its house sign. On houses in ancient (and modern) astrology, see Barton (1994a) 96-7 and Beck (2007) 85-6.
[130] Montanari Caldini's (1973) article has described how similar the astrological ideas across the two texts are.
[131] Lehoux (2007) 5.
[132] Neugebauer (1983) 69.

develop later than other forms of astrometeorology. But how much later; when do we begin to see instances of this kind of prediction?

We have seen above that Ptolemy discusses planetary prediction, so it must have been in some form of development by the 2nd century AD. It should be noted, however, the fixed-star astrometeorology was clearly of great importance at that time too, since Ptolemy himself wrote what is the longest and most detailed astrometeorological parapegma in existence, the *Phaseis*. What is deeply puzzling, however, is the one earlier instance of the planets having a role in prediction, in Vergil's *Georgics* 1.335-7:

> *hoc metuens caeli menses et sidera serva,*
> *frigida Saturni sese quo stella receptet,*
> *quos ignis caelo Cyllenius erret in orbis.*
>
> "In fear of this [a severe storm], mark the months and signs of heaven; to where Saturn's cold star withdraws itself and into what circles of the sky strays the Cyllenian fire [Mercury]."

Here, Vergil tells us that we can be prepared for destructive weather by watching the planets. In fact, he states it quite nonchalantly, almost as if in passing, not giving details of any kind. This would seem to suggest, then, that planetary prediction was developed to at least some functional level by the mid-1st century BC. If this was indeed the case, why the silence on the matter from our other sources? For example, why does Columella, so fond as he is of taking inspiration from Vergil, not discuss it?

There appear to be two options to answering this question. Either planetary prediction was developed and known to Romans by the mid-1st century BC, but it was overwhelmingly ignored in favour of the fixed-star astrometeorology we see in Pliny and Columella until the 2nd century. Alternatively, other sources recording planetary prediction may have been lost – perhaps Manilius may have discussed them, if ever he had got round to finishing his poem, or to dealing with the planets in detail. This, though, can remain only as speculation. Whichever is true, it does appear that the method of prediction in the Germanicus fragments is discordant with what we know about most of the wider predictive context of the 1st century AD. If we accept an early 1st century AD date for the Germanicus fragments, it must be with the awareness that the poem was potentially depicting a predictive method that was not widely used. However, since planetary prediction of the type depicted in them appears in more detail only from the mid-2nd century onward, I wish to also make the suggestion that a later date for the Germanicus fragments is also entirely possible.

To explore the potential for a later date, I wish to first take methodological inspiration from Emma Gee's reading of the Quintus Cicero fragment.[133] In this, she stresses the importance of the dates of authorial attributions when dating suspect fragmentary texts, rather than relying on what the attribution itself says, and in doing so has cast doubt over the date of the Quintus Cicero fragment. The first attribution of these fragments to Germanicus is in the early 4th century text *Divinae Insitutiones* by Lactantius, in which he quotes twice from a poem that he says is by Germanicus Caesar; one quote from fragment i.165,[134] the other i.113.[135] This, then, provides us with a *terminus ante quem* date of 303 AD (although this, of course, still assumes that fragments iii and iv belong to the same text as fragment i).[136] That a date as late as the 4th century AD should come into focus here is striking. Servius, the late 4th century commentator on Vergil, notes the following on line 336 of *Georgics* 1, which is quoted above:

> *ideo autem hoc dicit, quia Saturnus deus pluviarum est, unde etiam senex fingitur: nam senes semper novimus esse gelidos. hic autem in capricorno facit gravissimas pluvias, et praecipue in Italia…in scorpio grandines,item in alio fulmina, in alio ventos.*
>
> "Therefore he says this, because Saturn is a rainy god, and is imagined an old man. For we know that old men are always cold. So when in Capricorn, he brings terrible rain, and in Italy in particular…in Scorpio he brings hail, as well as lightning sometimes, and wind at others."

Evidently, then, planetary prediction remained in use long after Ptolemy, and Servius' reading of Vergil here, supplying additional detail, may suggest that it was a prominent method of prediction in the 4th century AD. In addition, it is noticeable that Servius' meteorological comments here are similar in form to those in the Germanicus fragments; it takes a planet and considers its meteorological significance when in a series of zodiacal signs. This should be contrasted with the planetary predictions in Ptolemy's *Tetrabiblos* given above, in which a planet is only considered meteorologically significant when it is in its 'house sign'. The predictions of the Germanicus fragments are thus far more detailed and comprehensive than those found in the *Tetrabiblos*. If we accept that the Germanicus fragments are perhaps as much as a

[133] Gee (2007).
[134] *Inst.* 1.21.28.
[135] *Inst.* 5.5.4.
[136] On the dating of Lactantius' works, see Bowen & Garnsey (2003) 2-3.

century older than the *Tetrabiblos*, then this, I would suggest, is a highly surprising thing to find, given the detail and importance of Ptolemy's work generally.

The meteorology of the Germanicus fragments iii and iv lead me to strongly doubt their dating to sometime in the first two decades of the 1st century AD. They appear to share predictive ideas more in common with Servius than with either Ptolemy, or, for example, Pliny and this, along with the Lactantius attribution, leads me to suggest a potential date somewhere in the 3rd century AD; after Ptolemy, but before 303 AD. This forces us, of course, to regard Lactantius' attribution as erroneous.

It is impossible to deny that planetary prediction was in existence earlier than this, since Vergil refers to it. Perhaps, though, if the Germanicus fragments are indeed later than previously thought, it could be that this method of prediction had a long period of development and refinement, of which Ptolemy's work was part, before becoming more widely used in the 3rd century. Whatever the reality of the date of these fragments, we must, for now at least, be content and willing to speak somewhat inconclusively about their status.

Returning now to the central narrative of this chapter; why the particular relationship I have described above developed between the two methods, and what was causing the increasing suppression of weather signs in favour of astrometeorology, must now be addressed. With this, I begin not with any process of change, but the significance of a single event, the Julian Calendar reform.

3. Meteorology and the Julian Calendar

I have argued above that we can see a change in the attitude towards weather signs in the short period between the early 1st century BC and the 1st AD, and that in this period, the dichotomy between weather signs and astrometeorology became such that some ancient authors appear to have very deliberately chosen one method over the other. This section will suggest that a specific link was made between the newly reformed Julian Calendar and astrometeorology and that this was highly influential in the promotion of astrometeorology as the primary method of weather prediction. This link and reform can be set against the significant context of the growing popularity and status of astronomy and astrology in Rome. These factors, I suggest, ultimately contributed to the relegation of weather signs away from being depicted as useful.

To think about the prominence of astrometeorology in Rome, it is first necessary to consider the reputation of astronomy more generally in this period. The fundamental narrative presented by Frederick Cramer in his seminal 1954 work is now the generally accepted one.[137] He depicted the late republic and early empire as the period of "the rise and triumph of astrology", during which astrology arrived in Rome from the Hellenic world and became increasingly influential in both politics and daily life.[138] There are now many studies that attest to, or rely on, this narrative and that demonstrate the importance of astrology and astronomy in the ancient world.[139] In this chapter, there will be a number of instances that point to the importance of astronomy, and the high regard in which it was held. We will see, for example, that astronomy could be depicted as the pinnacle of human understanding,[140] as a mark of learning, and thus as an indicator of elite social status.[141]

Other well-studied instances that attest to the importance and prominence of astronomy in Roman culture include the famous comet of 44 BC. This was reportedly visible for seven days above Rome during Caesar's funeral games, and quickly became a crucial piece of political propaganda, being used to simultaneously mark the deification of Julius Caesar and lend support to Augustus' new period of rule.[142] The comet was then exploited through allusions to it by poets such as Horace, Vergil and Ovid.[143]

The so-called 'Eulogy to Astronomers' at *Fasti* 1.295-310 also demonstrates the importance of the heavens.[144] In this passage, Ovid praises the work and role of the astronomer and/or astrologer. He refers to them as the *felices animae*, the 'happy souls' (v.297), before exulting in their ability to innovate new ideas and rise above the rest of mankind (297-300), the power of their minds (305-8), and their position as leaders (309-10). This too has been read politically, showing potential revisions following Augustus' edict against astrologers practicing in the Empire in 11 AD.[145] It is within this context of

[137] Cramer (1954).
[138] See Cramer (1954), especially 44-147.
[139] Barton (1994a), esp. 33-47 is a good example of this.
[140] See Cicero on astronomy, pp.184-5 below.
[141] See pp.192-9.
[142] Pliny, *NH.* 2.93-4 describes this. Ramsey & Licht (1997) Appendix I, pp. 155-177, gives a full list of ancient references and allusions to the comet and the funeral games.
[143] Major studies of the comet are: Weinstock (1971) 310-84; Domenicucci (1996); Ramsey & Licht (1997); and Gee (2000) 154-74, which focusses on the use of the comet in poetry.
[144] Key studies: Newlands (1995) 32-43; Barchiesi (1997) 178-80; Gee (2000) 47-65; Herbert-Brown (2002) 101-28); Green (2004) 135-48.
[145] See Cramer (1954) 99; Green (2004) 136; also Barton (2004b) 54-58 on this and later edicts.

the cultural prominence of star-gazing that I want now to turn to consider the Julian Calendar reform.

In 46 BC, Julius Caesar called upon the Alexandrian mathematician and astronomer Sosigenes[146] to help re-organise the civil calendar of Rome. The existing Republican calendar, a combination of lunar and solar cycles,[147] in which intercalation was left up to the discretion of the Pontifices,[148] had wandered, to varying degrees, out of alignment with the solar year – sometimes being as much as four months out of sync. Caesar replaced this flawed system with a new, purely solar calendar. This new calendar had an average of 365 and a quarter days, with the regular intercalation of a single day every four years. It did, as the Republican calendar had, have months, but these were fixed in length and now bore no strict relation to the actual lunar month. The traditional system of day naming, referring to the days in relation to the kalends, nones and ides,[149] was retained, as, initially, were the existing month names.[150] To aid its implementation, the number of days in 46 BC was altered to change the start of 45 BC so that the vernal equinox would fall at its assigned date, towards the end of March. The normal intercalary month from the Republican calendar was added, called the *mercedonius*,[151] along with two additional months totalling 67 days. As a result, that year contained 445 days, but this did ensure that the next year ran according to the correct solar events.

While the Republican civil calendar was organised by lunar-solar cycles, we saw from Cato's agricultural writing that astronomical time-reckoning, incorporating seasonal divisions, was the norm for the Roman agricultural tradition;[152] as Lehoux has suggested, we can imagine something akin to the system we saw being used in Hesiod's *Works and Days*.[153] Fairly rapidly after the calendar reform, we can see the new civil calendar being used with the traditional agricultural one, with stellar time-reckoning being converted to Julian dating in Varro's *On Agriculture*, written in 37 BC:

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[146] Ancient accounts of the reform can be found, with varying degrees of detail, at, amongst others: Ovid *Fasti* III.155; Suetonius Caes.40; Pliny *NH* 1857; Plutarch *Caes.*49; Macrobius *Sat* 1.14.
[147] Recent discussions of the Roman Republican calendar can be found in Hannah (2005) 98-106 and Lehoux (2007) 46-50, who staunchly argues against the prevalent view in a number of earlier pieces of scholarship that the Republican calendar was solely lunar.
[148] See Hannah (2005) 106-112 for a discussion of intercalation in the Republic.
[149] Richards, (1998) 210-11; table 16.2 on p.213, has a fine discussion and tabulation explaining this system.
[150] These are tabulated in Richards (1998) table 16.1, p.212. After Caesar's assassination in 44BC, the month Quintilis was renamed Iulius in his honour.
[151] 23 days long.
[152] On Roman 'civil vs. country' time, see Feeney (2007) 206-9.
[153] Lehoux (2007) 80.

> *Dies primus est veris in aquario, aestatis in tauro, autumni in leone, hiemis in scorpione. Cum unius cuiusque horum IIII signorum dies tertius et vicesimusIIII temporum sit primus et efficiat ut ver dies habeat XCI, aestas XCIV, autumnus XCI, hiems XXCIX, quae redacta ad dies civiles nostros, qui nunc sunt, primi verni temporis ex a. d. VII id. Febr., aestivi ex a. d. VII id. Mai., autumnalis ex a. d. III id. Sextil., hiberni ex a. d. IV id. Nov.*
>
> "The first day of spring [the sun] is in Aquarius, of summer Taurus, of autumn in Leo, of winter Scorpio. The twenty third day of each of these four signs is the first day of the four seasons, and this makes it so that spring has ninety one days, summer ninety four, autumn ninety one and winter eighty nine. Which, rendered in our current civil dates puts the first day of the season of spring on the VII Id. Feb, of summer on the VII Id. May, of autumn on the III Id. Sextilis, of winter on the IV Id. Nov…"
>
> - *Rust*. 1.xxviii.1

Lehoux has ably described the process we can see taking place here, stating that "as the Roman calendar evolved and established a better connection for itself with the solar year, the use of stellar phases gradually began to be replaced by, or at least intertwined with, Roman calendar dates."[154]

Cramer described this Julian Calendar reform as consisting of two parts; "the one astronomical, the other astro-meteorological".[155] While the astronomical details of the Julian Calendar reform have received a good deal of attention, the potential for an astrometeorological element has been greatly neglected.[156] It is the astrometeorological line of enquiry that I intend to pursue here, in an attempt to demonstrate that, with the Julian Calendar reform, efforts were indeed made to enable the integration of weather prediction into the Roman civil calendar in a way that had not previously been done. This prediction was astrometeorological in form, and the inclusion of this method represented a high-profile endorsement and bringing-to-prominence of astrometeorology. Weather signs, however, had no place in this process, thus reinforcing their increasingly sidelined status.

An Astrometeorological Reform?

The civil calendar of the late Roman Republic was, as I have already stated, a combination of approximate lunar and solar cycles. While the length of the year was governed by the time of a solar orbit, the 12 months of the year took their lengths

[154] Lehoux (2007) 51.
[155] Cramer (1954) 76.
[156] Hannah (2005), Feeney (2007) and Rüpke (2011), for example, do not mention in any detail the connection between the Roman (or Julian in particular) calendar and meteorology.

roughly from the periods between new moons (either 28, 29 or 30 days). As Lehoux has noted, to render dates for risings of constellations in this calendar would have been "very approximate at best", since the calendar months, and thus the main dating system for identifying days and the solar and sidereal year had only a very broad correlation between one another.[157] Similarly, then, applying astrometeorology, which relies on the precise dating of constellation risings, to this Republican calendar would not have been possible. Indeed, if we look at all extant Republican civil calendars, we find no evidence of weather prediction in any of them.[158] So, in Michel's reconstruction of a full calendar based on extracts from extant calendars, there is similarly no meteorological element.[159] Instead, the Republican civil calendar was concerned with cataloguing days for court business, assembly days and major festivals.[160]

That the Julian Calendar reform did indeed enable astrometeorology to be used with the dating system of the civil calendar is clear.[161] The following entry from Pliny's parapegma, for example, does precisely that:

> *XI kal. Sept. Caesari et Assyriae stella, quae vindemitor appellatur, exoriri mane incipit vindemia maturitatem promittens. eius argumentum erunt acini colore mutati. Assyriae V kal. et sagitta occidit et etesiae desinunt. vindemitor Aegypto nonis exoritur, Atticae arcturus matutino, et sagitta occidit mane. V id. Sept. Caesari capella oritur vesperi, arcturus vero medius prid. id. vehementissimo significatu terra marique per dies quinque.*
>
> "On August 28th the Arrow sets for Assyria and also the seasonal winds cease to blow. On September 5th the Vintager rises for Egypt, and in the morning Arcturus for Attica, and the Arrow sets and dawn. On September 9th, according to Caesar, the She-goat rises in the evening, while half of Arcturus becomes visible on September 12th, indicating very unsettled weather on land and at sea for five days."
>
> - *NH* 18.309-311

Here, dates according to the Julian Calendar are given, accompanied by stellar phases and the weather one can expect on those days. Because the civil calendar was now fixed to the solar year, and the stellar phases adhere to the same orbital period,[162] precise dates for star risings and settings, and thus weather patterns, can be given in dates adhering to that calendar. Not only could this be done, though, but the parapegma of

[157] Lehoux (2007) 51.
[158] I have consulted those in both Mommsen (1863) and Degrassi (1963).
[159] Michels (1967) 230 (illustration 4).
[160] See Michels (1967) 173-190 and Hannah (2005) 102-7 for fuller accounts.
[161] For more on the 'impact' of the reform, see Feeney (2007) 193-211.
[162] To the observer, at least. A sidereal year is approximately 1.000038 solar years, a difference of around 20 mintues.

Pliny (and also that of Columella, which displays very similar information) shows us that it was. Thus what was not possible under the Republican calendar became so with the Julian. But it is not enough here to demonstrate simply that a connection was made between the Julian Calendar and the weather subsequent to the reform; the more important question is whether the reform itself consciously included weather prediction from the beginning. To attempt to answer this question, we must turn our attention to the writings that supposedly accompanied the reform.

In the above passage from Pliny's parapegma, it is noteworthy that the source cited for the provided information is Caesar. This attribution is very common throughout the parapegma,[163] and has generated a reasonable volume of scholarship. Indeed, when presenting an overview of astronomy and the Julian Calendar, Pliny explicitly states that for the information he presents, he is indebted especially to the observations of Caesar (*nos sequimur observationem Caesaris maxime*: *NH*18.214), and it is this that we see occurring in the parapegma. This statement, with its context of the calendar reform, refers fairly unambiguously to Julius Caesar as author of the information, but certainly not to the precise source itself. As a result, there has been great scholarly push to identify this source as the lost work of Caesar, the *De Astris.* This is primarily because in his list of authorities used for the composition of book 18 of the *Natural History*, Pliny makes reference to a text written by Julius Caesar:

> *L.Tarutio qui Graece de astris scripsit, Caesare dictatore qui item.*
>
> "Lucius Tarutius, who wrote on the stars in Greek, Caesar the dictator, who did the same."

Assessing this reference as a source, however, has been further problematized by Pliny's statement at 18.57.212 that Sosigenes, the astronomer who he credits with aiding Caesar with the reform, wrote three commentaries on the reform himself. This has led now to the general scholarly opinion that the *De Astris* was a text released at the same time as the reform, but was a collaborative work between Caesar and Sosigenes. The precise nature of the text and collaboration, however, has been open to interpretation.[164]

[163] For example, *NH.* 18.214; 234; 237; 246; 247; 248 etc.
[164] Cramer (1954) 75 suggested Sosigenes provided the information and calculation, from which Caesar composed the *De Astris* as a parapegma; Le Boeuffle (1972) 28-9, Domenicucci (1990) 98 and Green (forthcoming, 2014) suggest the same input from each man, but that the final form was a treatise; Fantham (2009) 154 splits the difference and suggests a decree written by Caesar and a parapegma

I find it too ambitious to identify these references to Caesar with a specific, named text. Instead, I wish to use them to point to a more general conclusion; simply that Caesar (in some form; perhaps working in a collaboration, perhaps even just giving his name to the project) did indeed produce and release astrometeorological information that could be integrated into the new calendar (either as a parapegma, or simply an astrometeorological treatise), as Pliny has done,[165] and that these were either the same as, or accompanied in some way by, a series of treatises, probably under the authorship, or at least guidance, of Sosigenes. This is a broad and cautious conclusion but it does, though, enable me to suggest that the calendar reform did indeed have an astrometeorological thrust. With this astrometeorological component to the reform, I agree with Green that astrometeorology received prominent endorsement and exposure at the time of the reform.[166]

Parapegmatic references to Caesar, however, are not the only things that make me suspect that the weather was an important aspect of the reform, and subsequently, of the Roman calendar as a symbol of power. In around 10 BC, Augustus took control of the Roman calendar as *Pontifex Maximus*. Due to a series of intercalation errors, the calendar had drifted from its correlation with fixed solar points and Augustus was required to rectify it. [167] In doing so, he also constructed what is now seen as one of the archetypal monuments of Augustan Rome, the Horologium Augusti and, as I shall now demonstrate, the weather was once again placed at the heart of Roman calendar.

The Horologium Augusti

The Horologium[168] of Augustus has been at the centre of a large scholarly debate since the late 1970s, when Edmund Buchner, after finding a bronze-inlaid pavement[169] built on what was the Campus Martius, suggested that there once stood a colossal Egyptian obelisk which cast a shadow across a gridded sundial 'skirt' and which, on Augustus'

composed by Sosigenes both together made up the *De Astris*; Ramsey and Licht (1997) 98 n.12, however, suggest the *De Astris* was a poem composed by Caesar.

[165] Other parapegmatic sources, such as those by Clodius Tuscus, Ptolemy, Johannes Lydus, and al-Biruni also cite a 'Caesar'. Lehoux (2007) 492.

[166] Green (forthcoming, 2014) makes this point in relation to the *De Astris* in particular, not, as I do, the reform more generally.

[167] See Hannah (2005) 116-122, Heslin (2007) 3-6, Haselberger (2011) 47.

[168] The term 'Horologium' denotes some sort of time-reckoning function which, as I will show, does not seem to reflect the function of the monument. I therefore use the term solely as the standard, recognisable name for the monument.

[169] The pavement itself is of a Flavian date, but is believed to reproduce an Augustan original. The Bronze lettering employed shows signs of having been removed and reset – see Haselberger (2011) 55.

birthday, cast a shadow on the Ara Pacis.[170] His conclusions were substantially attacked during the 1980s and 90s, and it is now a widely, but certainly not universally,[171] held opinion that the obelisk was in fact accompanied by a simple meridian line.[172] On the east and west sides, the meridian pavement was enclosed in a brick wall.

As the year passed, the shadow cast by the obelisk *gnomon* would shorten along the west side of the meridian line, and then extend along the east. The shadow thus represents the passing of the Solar year; it is the physical representation of the astronomical scheme the Romans now used as their calendar. Unlike the kinds of sundials we have now, however, its function does not appear to be to enable the observer to place the present moment within a chronological scheme – the single meridian line does not enable this,[173] though some still insist that the Horologium is fundamentally a "time-piece".[174] Its basic function, then, is contested. I will here add a further, new suggestion for the function of the Horologium; that we should be viewing it as a heavily astrometeorological instrument in which the Julian year is closely allied to the weather.

The pavement has on it a single line running north-south, which is crossed by a series of shorter perpendicular lines.[175] A full account of the extant excavated labelling on the pavement is as follows:

- On the west side, running along the north-south line: [ΚΡΙ]ΟΣ and ΤΑΥ[ΡΟΣ]; "Aries" and "Taurus".
- On the east side, running along the north-south line: ΛΕ[ΩΝ] and ΠΑΡΘ[ΕΝΟΣ]; "Leo" and "Virgo".
- On the east side of the meridian line, running along an east-west line: ΘΕΡΟΥΣ ΑΡΧΗ; "the beginning of summer".

[170] Buchner's excavations and suggestions are collected in Buchner (1982). The extent of the shadow, and whether it would reach the Ara Pacis is a hotly debated issue. For the most recent set of arguments, see Haselberger (2011) 69; Schütz (2011) 83-6; Hannah (2011) 89-95.
[171] Recently, Rehak (2006) 85 has sided with Buchner's reconstruction.
[172] The debates concerning a range of aspects of the Horologium have been so repetitious and varied that articles are now being published about those debates: see Heslin (2007) and Haselberger (2011). Haselberger (2011) 70-3 publishes a bibliography of major publications on the Horologium dating back to 1523. Buchner's final publication of all his evidence and theories is understood to currently be in preparation.
[173] Hannah (2011) 88 has argued particularly strongly for the fact that the pavement of the Horologium is so imprecise that days and nights could be discerned on it. See also Heslin (2011) 76.
[174] See Haselberger (2011) 68, with Heslin (2011) 77 for rebuttal.
[175] Images are available in Buchner (1982) 100-1, 107, 110. A good illustration is now also available in Haselberger (2011) 54.

- On the west side of the meridian line, running along an east-west line: ΕΤΗΣΙΑΙ ΠΑΥΟΝΤΑΙ; "the Etesian winds stop".

Ostensibly, then, the Horologium allows its observer to track the movement of the sun through the signs of the zodiac, with occasional seasonal information being provided. But, we must ask, for what purpose? Heslin is amongst a number of scholars to suggest that the Horologium is fundamentally an astrological instrument of some kind,[176] which accounts for its zodiacal markings – knowing in which 'house' the sun is allows astrologers to carry out their practice. This suggestion does not, however, get to the bottom of the seasonal markers, or the weather-related ones; what does the beginning of summer have to do with astrology? For these, I think we need to substantially change our view of the significance of the zodiacal markings, and thus the nature of the Horologium.

What seems fairly certain about the Horologium is that the scientific ideas and models that underlie it are drawn fairly directly from Greek models. Beck, for example, has written about the fact that the very idea of representing the cosmos in a physical, schematic manner is in itself a Roman adoption of Hellenistic scientific ideas.[177] In addition to this general observation, there are also the more specific points of evidence that firstly, the inscriptions are in Greek, and secondly, the Etesian winds affect only the Eastern Mediterranean.[178] The inclusion of the Etesian winds, a meteorological element, has led to Hannah to suggest that the source for the Etesian winds information was a Greek parapegma.[179] He does not, though, consider how this affects our understanding of the monument as a whole.

If we work from the idea that the Horologium is derived from some sort of parapegma, and that this was astrometeorological in form, the pavement markings begin to reveal a great deal of unity. The Etesian winds and seasonal marker are easily accounted for; we expect this kind of information to be provided by an astrometeorological parapegma. But what of the zodiacal markings? Their inclusion, when considered in the context of Greek parapegmata, is not surprising either. The Geminus parapegma, for example, is organised based on the movement of the sun through the signs of the zodiac. Indeed, Lehoux has argued that Greek parapegmata are often organised along a zodiacal progression not because of the operation of a zodiacal

[176] Heslin (2007) 8.
[177] See Beck (1994) 108.
[178] This is noted by, amongst others, Beck (1994) 104, Hannah (2005) 129 and Heslin (2007) 8.
[179] Hannah (2005) 129.

calendar, but because the movement of the sun through the zodiac is considered to be astrometeorologically significant in and of itself.[180] That this kind of astrometeorology may have already gained traction in Rome is attested in the Quintus Cicero fragment, the meteorology of which is discussed above. I would suggest, then, that the Horologium Augusti is a monument concerned with showing how the solar year is linked with the seasons and the weather. Such a meteorological monument would not be entirely unique. There exists evidence of Roman sundials (of the more familiar type, which are capable of being used for assessing the time of day) which include a 'built-in' inscribed wind rose to indicate the direction of the blowing wind.[181]

As is often noted in scholarship on the Horologium, however, the sheer scale of the monument indicates that its function was "symbolic rather than utilitarian".[182] It stood to represent the importance and significance of the reformed calendar, which, like the Horologium, took the solar year as its fundamental unit of time (and to further highlight this, the Augustus dedicated the Horologium to the sun[183]), the unity of heaven and earth under Roman rule, as Rome now used the sun's cycles to measure its time, and, by using Greek script, a seemingly thus a Greek informational source and an Egyptian obelisk, the ownership of Greek and Egyptian thought by Rome. The astrometeorological element I have suggested here adds the fact that with the new, regular, solar year that the Julian Calendar has formally brought into Rome and Roman life, comes the predictable cyclicity of the meteorological year; the two run alongside one another, hand in hand, and Rome has mastered them both.

Reading the Horologium as an astrometeorological instrument raises some very significant points when considering Roman weather prediction. It shows us that the connection between the newly reformed calendar and the weather (through astrometeorology) was maintained beyond whatever publication was produced by, or in the name of, Caesar, and that it was made in a very explicit, public way. This was not a connection that was easily ignored or side-lined - it was a connection made by a public official, the *Pontifex Maximus* who was, more significantly, also the most powerful man

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[180] Lehoux (2007) 81-4; 97.
[181] See items 4002G, 4008G, 4010, 4009 and 5001 in Gibbs (1976) and on ancient wind roses more generally, Taub (2003) 102-6; 178-9. Haselberger (2011) 58-61 has compared the Horologium to wind roses, but does not see the Horologium as a meteorological instrument.
[182] Heslin (2007) 6.
[183] The inscription that accompanied the Horologium read as follows:
IMP·CAESAR·DIVI·F / AUGUSTUS / PONTIFEX·MAXIMUS / IMP·XII·COS·XI·TRIB·POT·XIV / AEGUPTO·IN·POTESTATEM / POPULI·ROMANI·REDACTA / SOLI·DONUM·DEDIT
"Imperator Caesar Augustus, son of a god, Pontifex Maximus, imperator for the twelfth time, consul eleventh, tribune fourteenth, with Egypt given to the power of the Roman people, has dedicated this gift to the sun"; *CIL* 6.701 and 702.

in Rome. So the official calendar of the State appears to have been accompanied by what was essentially the equivalent of a State-sanctioned weather prediction method – astrometeorology. This fact, I suggest, is a substantial part of the reason that astrometeorology became so much more preferred as a method of prediction to weather signs; the influential and high-profile connection made by the reform, as represented in the Caesarian text and the Horologium (although I would not wish to suggest that the connection could or would not have been made elsewhere too), set against a background of the growing influence of astronomy and astrology, inspired further trust in astrometeorology.

It certainly does seem, therefore, that Cramer was right to describe the Julian Calendar reform as part-astrometeorological. There is evidence to suggest that the two political figures behind substantial reforms, Julius Caesar and Augustus, both went to efforts to demonstrate that astrometeorology could be fitted into the Julian Calendar. It allowed the fixed stellar phase astrometeorology that can be found in the agricultural tradition to be unified with the calendrical functionality, being able to place festivals etc. at the right time, which was the purpose of the Republican civil calendar. Instead of having a calendar and a separate weather prediction method, Rome now had a calendar which could easily incorporate a weather prediction method. This, I would suggest, afforded astrometeorology the characteristic of being very easy and efficient to use; it simply runs alongside one's everyday calendar.

That the civil and meteorological could now be blended seamlessly is demonstrated in Ovid's *Fasti*. The following passage gives a good example of this:

> *Institerint Nonae, missi tibi nubibus atris*
> *signa dabunt imbres exoriente Lyra.*
> *Quattuor adde dies ductos ex ordine Nonis,*
> *Ianus Agnali luce piandus erit…*
>
> "When the Nones (5th of the month) are at hand, showers discharged from black clouds will be your sign, at the rising of the Lyre. Add four successive days to the Nones, and on the Agonial morning (9th of the month), Janus must be appeased..."
>
> - *Fast.* 1.315-318

Here, for the Nones of January, only an astrometeorological entry is provided – that it will rain when the Lyre constellation is rising. For the 9th of the month, though, Ovid provides details of the religious rites that must be carried out on that day to appease Janus. This combination shows us that the Julian Calendar could do what the

Repbulican could not – it could combine weather prediction with details of events of importance to the town. Thus it appears that the Julian Calendar had a role as much as an astrometeorological structure as it did a time-keeping one.[184]

In this section, I have suggested two reasons for the increasing dominance of astrometeorology in Rome: firstly, astronomy and the study of the night skies more generally was very much in the ascendant and was politically and publically valued and prominent; and secondly, as part of that popularity, astrometeorology was an integral part of the reformation of the Roman calendar that took place in 46/5 BC. This gave it two key things – influential endorsement and an economy of use since the same dating system could be applied to both the civil calendar and weather predictions. In this process, weather signs are, of course, entirely absent. They therefore receive none of the potential benefits of political involvement.

Having argued for the significance of a single event, the Julian Calendar reform, in the history of ancient discussions of weather prediction, I want now to reconnect to one of the threads of argument established earlier this thesis, that of the attempts to offer explanations for how weather signs work.

4. Explaining Weather Signs II

In the first part of this thesis, I argued against Sider and Brunschön's assertion that there existed an ancient Greek text, possibly even an Aristotelian one, which provided explanations for how weather signs worked.[185] The absence of such a text, the fact that weather signs stood on the fringes of traditional doxographical scientific debate, and that there appears to have been real difficulty in offering explanations for them, compounded, I suggested, doubt in the predictive ability of weather signs and thus their treatment. The problem of how to explain weather signs is one that the Roman writers seem to have inherited from a number of Greek sources, and the issue appears to somewhat hang over discussions of forecasting using this method. I will here discuss the explanations or comments about explanation for weather signs given by Roman authors, and argue that their frequent concern over the matter indicates that it is a reason for them also not presenting weather signs as practical predictors. As before, a comparison with the explanations given for astrometeorology will prove revealing.

[184] For a study of the relationship between Ovid's *Fasti* and the Julian Calendar more generally, see Gee (2000).
[185] See pp.63-4 above.

Neither One Thing nor the Other: Explanation in Cicero's De Divinatione

Cicero's *De Divinatione* once again forms our starting point for this topic. I argued above that the similar attributes of weather signs and portents led to a partial conflation of the two in the Roman mind. We will see here that the similarity between them is further reinforced and exploited where explanation is concerned. In doing so, I believe that Cicero employed the weather sign in the *De Divinatione* as a malleable entity, capable of being many things at once. This usage reflects, I think, the vagueness and uncertainty that surrounded them as a topic of investigation.

In his argument, Quintus suggests that when assessing the validity of divination, it is wiser to look at results, rather than causes. The causes, he says, are not understood, but the results of divinatory predictions speak for themselves. When discussing weather signs, Quintus makes it clear that the explanations for the operation of most weather signs are not known:

> *Atque his rerum praesensionibus Prognostica tua referta sunt. Quis igitur elicere causas praesensionum potest? Etsi video Boëthum Stoicum esse conatum, qui hactenus aliquid egit, ut earum rationem rerum explicaret, quae in mari caelove fierent. Illa vero cur eveniant, quis probabiliter dixerit?*
>
> [translation of Aratus' *Phaenomena*]
>
> *Videmus haec signa numquam fere ementientia nec tamen cur ita fiat videmus.*
>
> "Your book *Prognostics* is full of these predictive signs. But who can extract their causes? Yet I see that the Stoic Boëthus has attempted to do so and has succeeded to the extent of explaining the phenomena of sea and sky. But why the following things occur, who can give a plausible explanation?
>
> [translation]
>
> We see these signs almost never deceive, but do not see why."
> - *De Div.*1.13-15.

In this passage the Stoic philosopher Boëthus is referred to. In the previous chapter, I used this passage to read evidence from Geminus' *Isagoge* and thus suggested that Boëthus' explanations stopped with signs taken from the sky and the sea, as Cicero suggests. The selective use of quotations from Cicero's *Prognostica* here further reinforces this, and highlights the absence of explanations for animal signs from Boëthus' investigations.

The quotation referred to in the passage above, although continuous in Cicero's text, is actually a rendering of lines 913-15 and 948-950 of Aratus' *Phaenomena*:

Cicero:	Aratus:
Cana fulix itidem fugiens e gurgite ponti *nuntiat horribilis clamans instare procellas* *haud modicos tremulo fundens e guttere cantus.*	καὶ δ' ἂν ἐπὶ ξηρὴν ὅτ' ἐρωδιὸς οὐ κατὰ κόσμον ἐξ ἁλὸς ἔρχηται φωνῇ περιπολλὰ λεληκώς, κινυμένου κε θάλασσαν ὕπερ φορέοιτ' ἀνέμοιο...
Saepe etiam pertriste canit de pectore carmen *et matutinis acredula vocibus instat,* *vocibus instat et adsiduas iacit ore querellas,* *cum primum gelidos rores aurora remittit;* *fuscaque non numquam cursans per litora cornix* *demersit caput et fluctum cervice receipt.*	ἢ τρύζει ὀρθρινὸν ἐρημαίη ὀλολυγών· ἤ που καὶ λακέρυζα παρ' ἠϊόνι προυχούσῃ κύματος ἐρχομένου χέρσῳ ὑπέτυψε κορώνη…
"Similarly, the white egret, fleeing the swirling of the sea, crying out, announces terrible storms, pouring out no small voice from its throat."	"Also when to dry land a heron approaches from the sea with irregular flight shouting its scream repeatedly, it travels before a wind churning the sea…"
"Often the *acredula*[186] sings a lamentful song from its breast and threatens with its dawn chorus, threatens with its chorus and and emits from its mouth plaintive chatter, when first dawn releases the icy dew; and the dark crow, treading the shore, immerses its head and takes the flow on its neck."	"Or a solitary tree-frog[187] croaks its morning song; or perhaps a cawing crow along a jutting coast dips into the waves lapping up on the shore…"

A translation of the section of the *Phaenomena* from line 916 to 945 is not included here, or anywhere else in the *De Divinatione*.[188] Traglia suggested that this was due to Cicero mis-remembering this particular passage of the *Phaenomena*.[189] Wardle, however, has suggested that this is in fact "a deliberate quotation of what will be most relevant to the argument here",[190] but says nothing further. Wardle is right, I think, to assume more of Cicero than Traglia does.

We must keep in mind that Quintus here is trying to provide examples of weather signs for which explanations do not exist. Of the lines left out of this quotation, 916 to 945, the vast majority describe weather signs derived from clouds and from the location of thunder and lightning. Such signs, presumably, are, or closely resemble, those described and explained by Boëthus – since they could be classified as 'sky'

[186] On the identification of this animal, see Wardle (2006) 135-6.
[187] See Kidd (1997) 501 for discussions of this creature.
[188] Lines 946 and 947 are translated at *De Div* 1.15.
[189] Traglia (1966) 31 n.1.
[190] Wardle (2006) 135.

signs. They, therefore, would undermine Qunitus' position since they already have explanations attached to them. Quintus thus provides signs from birds and animals and by doing so, makes it clear that not only were they not explained by Boëthus, but even two hundred or so years after Boëthus' investigations, still nobody has the explanation for them. This latter point is made clear by two phrases: *illa vero cur eveniant, quis probabiliter dixerit?* (But who can give a satisfactory reason why the following things occur?); *Videmus heac signa numquam fere mentientia nec tamen cur ita fiat videmus* (Hardly ever do we see such signs deceive us and yet we do not see why it is so). It would thus appear that Cicero has carefully clipped the translation that is included so as to provide the best possible evidence for Quintus' argument.

With his reference to Boëthus and use of Aratus here, it is clear that Cicero turns squarely to Greek sources to offer explanations of how weather signs work. We have already seen how influential Aratus' poem was on discourse about weather signs, and can now identify some additional texts. First, as discussed above, the commentary of Boëthus, itself derived from Aratus' work, but also a passing reference made to a work of another influential Stoic philosopher, Posidonius.[191] At *De Div.* 2.47, Cicero tells us that the "causes of predictions", *causa prognosticorum*, have been investigated by Boëthius and "our friend Posidonius", *noster Posidonius*. Unfortunately, in none of the extant fragments of Posidonius[192] are weather signs mentioned, but the way in which Cicero bundles him up with Boëthus, we can hazard a guess that he produced a text similar to that of Boëthius. Thus we can see in discourse on weather signs a pattern typical of the transfer of Greek knowledge in this period more generally – the influence of the Stoic school in Rome.[193]

It is important to note that when looking to Boëthus, however, Cicero has evidently seen not just the presence of explanation, but the more significant absence of it; he has noticed the gap in Boëthus' account and this gap forms the focus of his enquiry. This critical analysis of key Greek texts will prove a central feature of Roman attempts to explain weather signs.

Quintus does make a vague suggestion for the reason some animals can act as weather signs. Discussing frogs, he suggests that they have *vis et natura quaedam significans*, 'a kind of natural force for giving signs' (1.15). He credits them, then, with

[191] The ancient evidence for Posidonius' influence in Rome is collected in Edelstein & Kidd (1989) Fragments T29-72. More his influence more generally, see Sedley (2006) 20-22.
[192] Collected in Edelstein & Kidd (1989).
[193] On this, see Sedley (2006) 20- 32 and Gill (2006). On Stoicism and Roman 'science'see French (1994) 166-171 and Lehoux (2012) *passim*, but especially 12.

some type of inherent sense for predicting the weather; the use of *natura* suggests that this is not something they have learnt (i.e. should they be reacting to other indicators), but is inbuilt into them by design. This idea, that animals have some additional sense for predicting the weather, is one that will recur throughout the Roman weather sign tradition and we shall return to it later. Quintus makes it clear, however, that the brief comment he makes on this awareness of frogs is as detailed as he is able to be. For although the sense is 'clear enough of itself', *per se ipsa satis certa*, it is 'too dark for human comprehension', *cognitioni autem hominum obscurior*. This lack of understanding of the causes of prognostic signs actually brings them into a closer comparison with portents,[194] since divination too is something that Quintus trusts but does not understand. He makes the direct comparison himself:

> *Sic ventorum et imbrium signa quae dixi, rationem quam habeant, non satis prespicio; vim et eventum agnosco, scio, approbo. Similiter, quid fissum in extis, quid fibra valeat, accipio; quae causa sit, nescio.*
>
> "In the same way I do not adequately understand the explanation for the signs of wind and rain which I have mentioned; I recognise, I know and I vouch for the force and the result of them. Likewise, I accept what 'the fissure' in entrails means or what 'a thread' means; as for their cause, I do not know."
>
> - *De Div.*1.16

Weather signs are therefore discussed in Cicero's text not only as a good example of something that has a similar appearance and function to divinatory actions, but as an example of a phenomenon that also has no real known explanation. For Quintus' comparison to work here, we must assume that the readers of Cicero's work were familiar with this particular position; with being aware of the existence of weather signs, but not understanding them. This seems eminently possible since, as demonstrated above, this is the position expressed in a number of Greek texts which were read by Romans. Quintus states that this position is true for his trust in divination:

> *Atque horum quidem plena vita est; extis enim omnes fere utuntur.*
>
> "And life is full of these people; and nearly everybody uses entrails."
>
> - *De Div.*1.16

Indeed, in this statement, it is not just Quintus who is dumbfounded by, but trusting of, divination, it is many other people too. That the trouble of explanation was a common feature of both divination and weather signs was made clear in the passage from 1.16

[194] Kany-Turpin (2003) 368-9 notes this as one of central tenets of the comparison between weather signs and portents in this text.

cited above, so it seems reasonable to assume that if many people held a confused but trusting attitude towards divination, they did, in all probability, hold the same attitude towards weather signs. It may well have been, then, that it was to some extent an acknowledged characteristic of weather signs; that no one could explain them. Not the Greek writers that were held in such high regard, and certainly no Romans.

It is when Marcus picks up the argument that we begin to see the uncertainty associated with weather signs further developed and exploited:

> *Atqui ne illa quidem divinantis esse dicebas, ventos aut imbres impendentes quibusdam praesentire signis (in quo nostra quaedam Aratea memoriter a te pronuntiata sunt) etsi haec ipsa fortuita sunt: plerumque enim, non semper eveniunt.*
>
> "And you said these things were not divination – the signs which predict approaching winds and rain (in connexion with which, you quoted a number of verses from my translation of Aratus). Yet such coincidences 'happen by chance'; for though they happen frequently they do not happen always."
>
> - *De Div.*2.14

In this passage, Marcus attempts to undermine Quintus' claims about divination; specifically, that divination is the prediction of events that happen by chance. Marcus argues that the relationship between weather signs and the weather they predict may be purely coincidental, because the predictions are sometimes right but not always, and thus happen by chance. Not only does this confuse the question of how weather signs work (if it is coincidence, how can any other explanation exist?) but also asks whether they are accurate enough to actually be trusted, if often they are not right. He then goes on to essentially refute his own claim, and give a more precise definition of what Quintus really meant by divination:

> *Quae est igitur aut ubi versatur fortuitarum rerum praesensio, quam divinationem vocas? Quae enim praesentiri aut arte aut ratione aut usu aut coniectura possunt, ea non divinis tribuenda putas, sed peritis. Ita relinquitur ut ea fortuita divinari possint quae nulla nec arte nec sapientia provideri possunt.*
>
> "What then, is this 'foreknowledge of things that happen by chance', which you call divination — and where is it employed? You think that 'whatever can be foreknown by means of science, reason, experience or conjecture is to be referred, not to diviners, but to experts.' It follows therefore that divination of 'things that happen by chance' is possible only of things which cannot be foreseen by means of skill or wisdom."
>
> - *De Div.* 2.14

The point resulting from this argument is that weather signs are not divination, since they predict events that happen by chance, but by using 'skill or wisdom'.

For a moment, however, in the first of these two passages, Marcus is very directly grouping the predictions of weather signs with those of divination, arguing that they would be, according to Quintus' definition, the same. The logic of the argument is sound – weather signs do indeed seem to predict events that occur by chance; they are therefore the same as divination. Previously in this chapter I pointed out that when discussing 'technical' predictions, Cicero uses the examples of a physician, the pilot of a ship, a farmer, and sometimes a general. Why, then, when discussing definitions of divination here, (during which one of the 'skillful' prediction methods needs to be portrayed as predicting events of chance in order to undermine the definition of divination) does Cicero favour the pilot and his weather signs? The fact that, as the passages above demonstrate, weather signs can be seen to embody both a very technical discipline (in that their reputation as 'specialist knowledge' is at times stressed), but also a very un-scientific, imprecise discipline (in that they appear to share many characteristics with divination and, as I have argued, are consistently conflated with divination and portents in the *De Divinatione*) must lie at the heart of their appeal here. It seems that they are very easily depicted as either one or the other. I think that this is a reflection of how weather signs were viewed; with some confusion. We have already seen that some had explanations attached to them, whereas others did not and this both reflects and feeds into the uncertainty associated with them.

A good comparison can be made here with modern 'alternative medicine'. There are official-sounding national bodies that regulate its practice and provide accredited training courses, there are shops on high-streets dedicated to branches of it, and there are many books that espouse its safety and efficacy. But similarly, there are books that warn of falsehoods and danger, studies that question its methods and ethics, and groups devoted to its downfall. It is very easy to portray it one way or another because there is a public uncertainty that surrounds it; people are not sure whether it is trustworthy or not.[195]

[195] For more on the trust in, and presentation of, alternative medicine, see Singh & Ernst (2008) 9-12; 286-350.

Continuing Ambiguity: Vergil's Georgics *and beyond*

The need to explain how weather signs work appears also in the weather sign section of the *Georgics*. Immediately following a sign from rooks, Vergil breaks from his list of signs, to include the following passage:

> *haud equidem credo, quia sit diuinitus illis*
> *ingenium aut rerum fato prudentia maior;*
> *uerum ubi tempestas et caeli mobilis umor*
> *mutauere uias et Iuppiter uuidus Austris*
> *denset erant quae rara modo, et quae densa relaxat,*
> *uertuntur species animorum, et pectora motus*
> *nunc alios, alios dum nubila uentus agebat,*
> *concipiunt: hinc ille auium concentus in agris*
> *et laetae pecudes et ouantes gutture corui.*
>
> "I do not believe that they have divine wisdom, or a larger foreknowledge of things to be through fate; but that when the storms and movable moisture of the sky have turned their course, and Jove, wet with the south winds, thickens what just now was thin, and makes thin what was thick, the 'phases of their minds' change, and their 'breasts now conceive impulses', other than they felt when the wind was driving the clouds. So that chorus of the birds in the fields, the gladness of the cattle, and the exulting cries of the rooks."
>
> - *G.*1.415-423

When the weather changes and cause pressure alterations, Vergil tells us, animals detect it and modify their behaviour. They do not offer signs because of divine wisdom or knowledge of future events. The line that gives this explanation, though, *uertuntur species animorum et pectora motus,* is an oddly vague one,[196] and I think it has somewhat been taken for granted in modern scholarship. It is often seen as 'Vergil's explanation', with the assumption that its meaning is clear.[197] I would suggest, however, that it is really not. What exactly are *species animorum*, after all? Or, for that matter, *pectora motus*?

There has been no real attempt to answer these questions since that of T.E. Page in 1903. He suggested the following:

"The word *species* is used with great skill. Virgil wishes to describe the effect produced on the birds as due to a mere change of the physical condition of the atmosphere, and therefore he selects a word which is often used of things impalpable (e.g. a vision, a phantom), but which is used also of the 'shape', 'aspect', 'appearance'

[196] As Thomas (1988) 138 has noted. He suggests that Vergil "may have in mind…some sort of humoral theory", but goes no further.
[197] See, for example, Gale (2000) 85, who simply says that there are "changes in atmospheric pressure which motivate the animals behaviour". This makes it, she says, a "scientific" explanation.

of material things, and so suggests that the soul or mind of the birds has an 'aspect' or 'shape' which changes in the atmosphere can affect. Probably Virgil conceived of the *animus* as something of a fine and ethereal nature.

Similarly *motus* is skilfully chosen, being equally capable of a material sense = 'movements' or a spiritual sense = 'emotions'."[198]

Page is right to see ambiguity in the language of Vergil here. It is not clear whether these terms are being employed for physical or intangible entities. The diction is ambiguous, as are the things that may potentially be referring to. I think it possible that this ambiguity is entirely deliberate on Vergil's part. He appears to reject a divine explanation, and offer a physical one but this is as precise as we can be. Indeed, the vagueness of his language may suggest that this is as precise as Vergil himself could be. Rather than offering us a clear explanation, he is essentially saying that 'when the weather is changing, animals can tell and they feel different'. It is difficult not to be reminded of Quintus' comment, discussed above: *Sed inest in ranunculis vis et natura quaedam sicnificans aliquid per se ipsa satis certa, cognitioni autem hominum obscurior*. I would suggest, then, that Vergil is really going no further than Cicero did, since he is simply unable to do so; he is suggesting that animals can sense changes, and that this does something inside them, but not any more than that.

Thinking about the parity between Cicero and Vergil is actually a useful path to follow to further explore this passage of the *Georgics*. The explanatory passage has come to be seen in Vergilian scholarship as a point of conflict between rationalism and theism.[199] Miles called it "mechanistic rather than theological",[200] and similarly Thomas saw it as a moment at which "V[ergil] rejects divine or supernatural explanations for the ravens' behaviour…preferring more rational, barometric reasoning".[201] These readings rely on *Iuppiter* of line 418 (see above) being taken to refer simply to the sky.[202] The passage finally received a more subtle reading in Monica Gale's book.[203] Gale argues that the explanation offered by Vergil actually poses a question over the operation of the universe; not a definitive answer one way or the other as Miles and Thomas would have it. While it first appears to present a rationalistic viewpoint, this is undermined by the presence of Jupiter "as agent of the changes in atmospheric pressure which motivate the

[198] Page (1903) 233.
[199] For a wider ranging discussion of '*religio*' and '*ratio*' in the *Georgics*, see Kronenberg (2009) 132-142; 157-162.
[200] Miles (1980) 103.
[201] Thomas (1988) 137.
[202] For this interpretation, see also Mynors (1990) 87. For discussion, see Gale (2000) 85 n.86.
[203] Gale (2000).

animals' behaviour".[204] This, she argues, is Vergil playing Lucretius,[205] with his rationalistic non-theist universe, off against Aratus, who has his divinely organised and controlled universe.[206] Thus rationalism and theism are set beside one another, and the lines between them blurred. I find Gale's underlying argument about the barriers between these conflicting explanatory positions being distorted, and that this passage poses the question of explanation rather than answering it, an attractive one. However, I do think that there is much more going on in this passage that supports this idea than she realises and that looking just for the *De Rerum Natura* and Aratus' *Phaenomena* is thus too limited an approach. I suspect that other texts are just as influential here and that as a result, stopping the analysis at the level of 'rationalism versus theism' is a more fruitful approach.

Let us begin by briefly outlining where Gale sees Lucretius in this passage.[207] She argues that *diuinitus*, which features in line 415 of the passage, is a "Lucretian catch-word" since it is featured eight times in Lucretius but is otherwise rare in poetry. The construction also appears to be Lucretian, with a rejection of a competing view followed with *verum*, and this passage, like Lucretius' poem, features a first person interjection (*credo*). The anaphora *alios, alios* appears where Lucretius discusses bird cries (*DRN* 1.1081) and the phrases *nubile ventus agebat* and *laetae pecudes* recall similar Lucretian expressions.

Aratus, and his Stoic viewpoint, are hinted at firstly by the very contents of the passage in question – weather signs, for which Aratus was Vergil's primary source – and secondly, the suggestion that we should look to Jupiter in order to explain natural phenomena (if we follow Gale's reading of *Iuppiter* as potentially meaning the god, rather than just being a metaphorical phrase for the sky).

I have no objection to seeing Lucretius in the language, construction and didactic techniques of this passage, but I think that by looking towards Cicero's *De Divinatione* we can actually see a tradition that is influencing the content of Vergil's explanatory passage. I argued above that the attempt to explain weather signs that featured in the *De Divinatione* had the effect, at times, of drawing them closer to portents. We are able to conclude from Cicero's discussion that weather signs and portents use virtually identical sources for their signs, can look very similar when put in

[204] Gale (2000) 85.
[205] For Lucretius' influence on the *Georgics*, see Gale (2000) *passim*.
[206] Gale (2000) 83.
[207] From Gale (2000) 85 n.85.

similarly-constructed lists and perform a very similar 'future prediction' function of events that happen by chance. What theoretically separates them is that weather signs are a 'skilful' method of prediction, whereas portents are a 'divine' one. They are essentially counterparts sitting on either side of the rationalist/theist division. They are also, however, conflated together when necessary and we have seen how easy it could be to blur the distinction between the two, aided by a lack of clear understanding. Vergil, I suggest, may well be presenting us with a similar thing. He too balances weather signs and portents through the structure of the close of book 1 while simultaneously conflating them, on which I have already commented in detail above. For him, then, potentially building on Cicero's analysis, weather signs could be considered to sit on the line between the divinely-inspired and skilfully-human. This is essentially what Gale's reading had begun to suggest- that explaining the weather signs is one of the points at which Vergil plays up these two ways of viewing the operation and nature of the world. Vergil, then, is using weather signs in a strikingly similar way to Cicero. Both are exploiting the malleability of weather signs, in particular, their ability to be easily presented and understood as simultaneously 'skilful' and 'divine', and their similarities with divination by portents. Indeed, could there be a more perfect opportunity to slip in a comment questioning the dichotomy of rationalism and theism than with something that already has a history of crossing, in the *De Divinatione* and elsewhere, those boundaries? The fact that, at the beginning of his explanatory passage, Vergil dismisses the argument that weather signs are in some way 'divine' does rather suggest that he is aware that they could be interpreted as such or that the issue of their potential explanation as divine signs is in some way at stake. The source for this comment may have been from Epicurus' explanation of weather signs, discussed above, but quoted, for reference, again here:

> Αἱ δ' ἐπισημασίαι αἱ γινόμεναι ἐπί τισι ζῴοις κατὰ συγκύρημα γίνονται τοῦ καιροῦ. οὐ γὰρ τὰ ζῷα ἀνάγκην τινὰ προσφέρεται τοῦ ἀποτελεσθῆναι χειμῶνα, οὐδὲ κάθηταί τις θεία φύσις παρατηροῦσα τὰς τῶν ζῴων τούτων ἐξόδους κἄπειτα τὰς ἐπῖ σημασίας ταύτας ἐπιτελεῖ.
>
> "The signs of the weather which are given by certain animals result from mere coincidence of occasion. For the animals do not exert any compulsion for the winter to come to an end, nor is there some divine nature which sits and watches the outgoings of these animals and then fulfils the signs they give."
>
> - *Epist. Ad Pyth.*115:

Gale mentions this passage only in passing,[208] but I see no reason why this could not be Vergil actively engaging with Epicurus' theories. Epicurus' statement is, after all, the only point, in the extant examples at least, where the gods' involvement in weather signs is explicitly and specifically denied. Vergil is doing the same and it does not seem unreasonable to suggest that he has Epicurus in mind. This may indicate that Vergil is consciously engaging with the history of the explanation of weather signs, thus making it more possible that he was aware of their interpretation as liminal between the human and divine, as demonstrated by Cicero. This is further supported by the signs that Vergil attached his explanation to.

Strikingly, the passage is focussed around signs taken from animals, as demonstrated by the mention of birds, cattle and rooks. It is possible to read this as standing for all the weather signs, but I would favour a more specific reading here. Cicero's *De Divinatione* made it clear that the investigations into weather signs up to that point had found reasons only for signs related to the sea and the sky. Quintus thus picks out animals as an area in which explanations were lacking. It seems more than possible, then, that Vergil is responding to and building on the weather signs studied that preceded his text. Perhaps he himself had read Boëthus' work, or, as seems increasingly likely, was familiar with Cicero's philosophy. These additional texts that seem to have a role in a reading of Vergil's weather sign explanation are what make me think that an interpretation that is solely Aratean and Lucretian is too narrow. Vergil is, I have suggested, exploiting the ambiguity of weather signs in a broader way than this, by calling upon the history of researches into them.

There is an elegant parity between what we can extrapolate from Page's reading, and what we can take from Gale's. Both allow us to see that Vergil seems to be stressing the slippery, changeable and somewhat unknown nature of weather signs. The language he employs is abstruse and vague, as is his explanation itself. This further reinforces what was emerging from the analysis of Cicero's *De Divinatione* above: weather signs do seem to have a particular reputation for being unexplainable and not well understood at all.

This reputation did not diminish as time went on. Pliny addresses the problem briefly in the *Natural History*:

[208] Gale (2000) 85 n. 85: "see also Epic *Ep. ad Pyth.*… where divine involvement is explicitly denied".

> *Milia praeterea, utpote cum plurimis animalibus eadem natura rerum caeli quoque observationem et ventorum, imbrium, tempestatum praesagia alia alio modo dederit, quod persequi inmensum est…*
>
> "There are thousands of points beside, inasmuch as nature has also given very many animals the faculty of observing the sky, and different prognostications of winds, rain and storms in a variety of different modes - something which it would be an immense task to pursue…"
>
> - *NH.*8.102

Pliny here seems to adopt the view that each weather sign would require individual explanation – animals are aware of signs of forthcoming events, *praesagia,* in a 'variety of different modes', *alio modo*. Beagon is right that this *praesagia* "need not be seen as a mysterious prophetic power" and that "Pliny attributes *praesagia* to nothing more than superiority in the physical senses".[209] To demonstrate this, Beagon uses the example of Pliny's description of a fox (at 8.103), but we can just as easily turn to his weather sign section in 18, in which he comments on the sensitivity of birds:

> *Nec mirum aquaticas aut in totum volucres praesagia aeris sentire:*
>
> "Nor is it surprising that aquatic birds or birds in general perceive signs of coming changes of atmosphere."
>
> - *NH.*18.364

The predictions here are linked explicitly to birds ability to sense, *sentire,* changes in the atmosphere. Perhaps the different 'modes' mentioned above therefore refer to the different things that animals are able to sense. Pliny would thus appear to adopt a broad unifying theory for the explanation of weather signs – that animals are particularly sensitive to change – but says that an investigation of exactly what each animal is detecting, and the effect that detection is having, is a task too great for even him, a man not afraid of large volumes of information, as his work as a whole attests to. Here again, then, we see the difficulty associated with explaining weather signs spelt out; either the explanations of weather signs are so complex that it would take a ludicrous amount of time to attempt to understand each one, and/or Pliny just does not think the effort required to produce these explanations would yield sufficiently interesting or worthwhile results. This passage of Pliny does, however, allow us to see how pervasive the idea of innate animal prescience was in the Roman world; we have seen it in Cicero,

[209] Beagon (1992) 142.

Vergil and Pliny. As we have seen above, this is not something that typically appears in Greek explanations.[210]

Quintus' comments, quoted above, that he trusts weather signs but does not understand them, and that arguments are best made not from causes but by analysing results, may seem to problematize the argument I am making here: clearly the availability of explanations is not something that would affect whether he would use a particular prediction method. But, as Lehoux has noted, "Marcus wastes little time cutting to the methodological question and insisting that causes are needed if Quintus' stories are to be convincing."[211] There is, then, evidently a strong sense in Roman thought that understanding underlies trustworthy predictions and thus that we can look to a lack of successful explanations as a potential reason for the rejection of weather signs. To illustrate his point that explanations do matter, it is interesting to note that Marcus turns to astronomy:

> *Qui potest provideri quicquam futurum esse quod neque causam habet ullam neque notam cur futurum sit?... Vident ex constantissimo motu lunae quando illa e regione solis facta incurrat in umbram terrae, quae est meta noctis, ut eam obscurari necesse sit…*
>
> "How can anything be foreseen that has no cause and no distinguishing mark of its coming?... [Astronomers] calculate from the perfectly regular movements of the moon when it will be opposite the sun in the earth's shadow – which is 'the cone of night' – and when, by necessity, it will become invisible…"
>
> - *De Div.* 2.17

Here, Marcus leans on the predictions that are made of astronomical phenomena (those of eclipses, the movement of the planets through the zodiac and the regular risings and settings of stars) to support his claim that explanations are necessary to produce sound predictions. Astronomy is thus used as the discipline about which there is such sound understanding that predictions made concerning it are flawless.[212] Unfortunately, Cicero does not make claims about explanations of astrometeorology, so a direct comparison cannot be made between the predictive methods here. However, his statement provides a revealing background against which we can ask whether astrometeorology was viewed in the same light; did the degree of understanding of astronomical matters that Cicero suggests exist extend to astrometeorology too?

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[210] Interestingly, Bouffartigue (2003) 402 -3 has noted that Greek Peripatetic philosophers note that animals are often intelligent, but do not extend this to innate prescience.
[211] Lehoux (2012) 44 on *De Div.* 2.27.
[212] Astronomical knowledge as a marker of status will be discussed later, pp.192-9.

Explaining Astrometeorology

Above, we saw Geminus presenting two explanations for astrometeorology in his *Isagoge*.[213] The first was based on the Aristotelian principle that weather is caused predominantly by the movement of the sun, and that the stars therefore act as temporal signals. The second suggested that the weather is caused by the stars and constellations themselves; that the stars are actively influencing events on earth, which we can, for ease, term 'stellar causality'. In the last six years, there has been a small but steady scholarly interest in Roman astrometeorology and the ideas of stellar causality more generally.[214]

Beginning with Pliny's *Natural History*, which is our only Roman source to include both detailed astrometeorology and weather signs, it is noticeable that for weather signs, as we have already seen, Pliny tells us that animals detect weather changes in some way, but that the details of that detection are not worth the effort of discussion in his work. Astrometeorology, however, does get an explanation. In a section discussing rain, he states:

> *ut solis ergo natura temperando intellegitur anno, sic reliquorum quoque siderum propria est cuiusque vis et ad suam cuique naturam fertilis.*
>
> "Therefore as the nature of the sun is understood to control the year's seasons, so each of the other stars also has a force of its own and an effect corresponding to its nature."
>
> -*NH* 2.105

Here, causality is clearly the explanation favoured by Pliny. He explains that the stars affect the weather, just as the movement of the sun creates the seasons. He then continues, explaining that it is not just the moving stars that have influence – the fixed ones do too, and of the large constellations, each part of them has its own individual influence.

A potential explanation, however, is suggested by a comment in Columella's *De Re Rustica*:

> *…si persuasum habuerit, modo ante, modo post, interdum etiam stato die orientis vel occidentis competere vim sideris.*

[213] See page 76-7.
[214] Primarily that of Lehoux (2006), (2007), (2012), but also currently Green (forthcoming, 2014).

> "…if he [the farm bailiff] has persuaded himself that the influence of a star makes itself felt sometimes before, sometimes after, and sometimes on the actual day fixed for its rising or setting."
>
> - *Rust.* XI.1.32

The *vis sideris* in this passage seems to imply that the stars themselves have some power or influence on terrestrial events[215] and can thus been seen as a statement in support of stellar causality as an explanation for astrometeorology; note that Pliny too uses *vis* to refer to stellar influence. It is important to note, though, that Columella is not actually offering an explicit explanation for astrometeorology here, modern scholarship has just deduced an explanation from his statement. Perhaps, though, Columella felt no need to justify the theory that underlay his astrometeorological predictions, as may have had to be done had he chosen to use weather signs. We see that Pliny offers a clear explanation, so there evidently was a contemporary explanation, and thus maybe the issue of stellar causality in the weather simply did not need expanding upon by Columella.

Lehoux has argued that the stellar causality mechanism described in this astrometeorological context is in fact a form of sympathy,[216] a physical force that by the actions of one thing causes a response from another, and which was a very popular and influential Stoic scientific idea in 1st century BC to 2nd century AD Rome, having, as Lehoux has shown, "a very wide explanatory and evidential sweep".[217] Lehoux links the general notion of stellar causality with the more specific one of sympathy due to a statement by the 2nd century AD philosopher Sextus Empiricus. At *Adv. Math.* ix.79,[218] Sextus states that Roman Stoics saw astrometeorology as evidence for their notion of sympathy. Despite the clear similarities between the operation of stellar causality and sympathy, I am more hesitant than Lehoux is to impose Sextus' specific contention so readily and broadly back over the previous two or three centuries. Identifying that Columella and Pliny, for example, specifically have sympathy in mind is not possible. Instead, I favour the approach of Green,[219] who has considered the issue of stellar causality more generally, without tying it to the specific concept of sympathy, but still showing that the idea that the stars were influencing the weather was a popular and

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[215] Lehoux (2007) 53.
[216] Lehoux (2006) 107-9; (2007) 53. McCartney (1926b) 53 made the same connection, but not in any detail.
[217] Lehoux (2012) 135. Major studies of sympathy in the Roman world are Reinhardt (1926), who discusses it in the context of Stoicism, and now Lehoux (2012) 135-54, who links it to Roman science.
[218] Lehoux (2007) 53 n.69 erroneously cites this as viii.79.
[219] Green (forthcoming, 2014).

pervasive one. Regardless of this issue, however, it is clear that the causal explanation that Geminus so objected to thus appears to have become popular in the Roman world, and potentially brought under the over-arching contemporary theory of sympathy, though precisely when that occurred, it is not possible to say.

Causality is not the only explanation offered, however. Like Geminus, Sextus Empiricus, in the opening on his attack against astrologers, actually argues that while the predictions made by astrometeorology are acceptable as predictions, they are the result of a pattern of the temporal relationship between the stars and the weather, rather than any causal connection, which he compartmentalises as the basis of astrology:[220]

> Περὶ ἀστρολογίας ἢ μαθηματικῆς πρόκειται ζητῆσαι...οὔτε τῆς παρὰ τοῖς περὶ Εὔδοξον καὶ Ἵππαρχον καὶ τοὺς ὁμοίους προρρητικῆς δυνάμεως ἣν δὴ καὶ ἀστρονομίαν τινὲς καλοῦσι (τήρησις γάρ ἐστιν ἐπὶ φαινομένοις...)
>
> "The task before us is to inquire concerning astrology…not that of prediction practised by Eudoxus and Hipparchus and men of their kind, which some also call 'astronomy' (for this consists of the observation of phenomena…)"[221]
>
> - *Adv. Math.* v.1-2

Sextus Empiricus is the only Roman source in which we have this temporal relationship described. We have, though, seen that it is attested much earlier, described in Geminus *Isagoge* and as an underlying theory in Aristotle's *Meteorologica*. It therefore seems likely that it was still accepted as an explanation in the period between Geminus and Sextus. Strikingly, it is noteworthy that Sextus here provides a ringing endorsement of astrometeorology. As Lehoux has noted, although Sextus attacks other forms of what he considers 'astrology', astrometeorology is allowed to stand.[222] This stands, just as it did when Geminus did the same, as testament to the respect given to the predictions made by astrometeorology.

Constantly hanging over weather signs, then, seems to have been the problem of explanation. This was not the case with astrometeorology, which could still be explained in two 'full' ways, much as they could when Geminus was writing. On the one side was the idea of causality, for which we certainly have more evidence, and on the other a temporal relationship. The passage from the *De Divinatione* above showed us that astronomical phenomena were considered to be very well understood and this may be the reason why authors such as Columella did not feel it necessary to discuss the

[220] See Lehoux (2007) 56 and (2012) 162-3 for further on this passage.
[221] Bury (1949) translation.
[222] Lehoux (2012) 162.

issue of explanation; if you accept one of the explanations, there are simply no questions to pose, since astrometeorology was understood.

As in the Greek tradition, then, we have seen that explanation was probably an issue faced by Romans when they came to select a predictive method to apply to the weather. We have seen from Cicero that there was a concern with placing ones trust in the unexplained, and that weather signs fell firmly into that category. Astrometeorology, however, did have explanations attached, and ones that were potentially allied to an influential Roman view of the world. This further difference between the two methods contributed, I would suggest, to the increasing abandonment of weather signs, and the rapid adoption and trust in astrometeorology.

We can now turn to look in further detail at the status attached to astronomical knowledge in the Roman world, and consider how this may have affected the selection of weather prediction methods.

5. Urban/Rural Meteorology in Roman Thought

In the first chapter, I suggested that depictions of weather prediction in Greek literature could be used to evoke rurality and to characterise and describe 'rural practitioners', and specifically farmers and sailors. I wish now to pick up that same theme, but argue that, in Roman hands, it underwent a modification. Rather than weather prediction as a whole being connected to rural life, we begin to see the effect of the growing divide between astrometeorology and weather signs that I demonstrated earlier. In the texts discussed in this section, we will see that the two methods are separated along the lines of the Roman perception of an urban/rural division; while astrometeorology is chosen as befitting the sophisticated and intelligent (and thus, perhaps more specifically, the urban), weather signs became the hallmark of country-dwellers (and thus, the inherently ignorant). These depictions, which are also no doubt linked to the politicisation of astrometeorology I described in the previous section, are a reflection of how elite Romans thought about knowledge in relation to social status. By contrasting Lucan and Columella, the former's work containing weather signs at the expense of astrometeorology, the latter's astrometeorology at the expense of weather signs, I will suggest that understanding their views on urbanity and rurality can give us further indication of why weather signs were suppressed in the literature of this period. It must be emphasised here that my interest in this section does not lie with, for example, the economic connections between rural and urban life in Italy in the period covered by this

chapter, or with the realities of cultural exchange between the city and country. I am concerned solely with how Roman thinkers perceived a potential urban/rural divide; how they themselves saw city life differing from country life and 'city folk' differing from 'country folk'. I will begin by considering, in fairly broad terms, the Roman view of the countryside and the role knowledge plays in this, before discussing how we can use this view to understand the history of weather prediction.

Views of the Countryside

Philip Thibodeau's recent study of the treatment of rural life in Latin literature[223] has served to emphasise that Roman writers have a paradoxical view of life outside the urban centre of Rome. On the one hand, the countryside is seen as the idyllic location of a simple life, where virtue is easily obtainable and the hustle and bustle of a political career can be forgotten; but on the other, it is an outmoded backwater, cut off from 'modern' life and full of ignorant, un-kempt farmers who speak in an un-cultivated manner – a place thoroughly unsuited to the wealthy, educated Roman man.[224]

As Tibodeau has noted,[225] Catullus takes a typically negative view of life outside the *urbs*. In a scathing attack against a fellow poet, Catullus mocks Suffenus by exploiting the contrast between the urban and the rural. He is described initially as *venustus* ('charming') and *dicax* ('witty'), character traits which go hand in hand with another of his positive attributes – being *urbanus* ('urbane')[226]. When writing poetry, he changes and becomes not this city wit, but something associated with the countryside:

> *idem infaceto est infacetior rure*
> *simul poemata attigit…*
>
> "He is clumsier than the clumsy country
> whenever he tries poetry…"
> - Catull. 22.14-15.

Here, then, Catullus, very clearly associated with city with intelligence and sophistication, which he does through his use of the word *urbanus*, with its linguistic link to *urbs*, and the countryside with being un-educated and un-cultivated.

[223] Thibodeau (2011).
[224] See Thibodeau (2011) 25-7; 78-80.
[225] Thibodeau (2011) 81.
[226] Catullus, 22.2. For more on constructions of *urbanitas* in Catullus, see Fitzgerald (1995) 87-114; Wray (2001) 124-7.

Connected notions of the superiority of the urban environment, and the potential shame of being associated with rurality, and agriculture in particular emerge in the *Satires* of Juvenal. We can look, for example, to the end of satire 8. In this satire, Juvenal attempts to persuade the aristocratic gentleman Ponticus to rely on his own achievements, and keep from focussing on those of his ancestors. To reinforce his argument, Juvenal produces a *reductio ad absurdum* argument, which traces the very oldest Roman families to their origins:

> *et tame, ut longe repetas longeque revolvas*
> *nomen, ab infamy gentem deducis asylo;*
> *maiorum primus, quisquis fuit ille, tuorum*
> *aut pastor fuit aut illud quod dicere nolo.*
>
> "After all, although you trace your name far back and unroll it far back,
> you derive your family from the notorious 'refuge';
> the first of your ancestors, whoever he was, was either
> a herdsman or something I'd rather not mention."
> - Juv. 8.272-5.

Many great families of Rome, Juvenal argues, originate from the 'asylum of Romulus', a supposed safe-haven for the criminals and bankrupt of other cities opened by Romulus to increase the population of Rome.[227] The implication here, of course, is that however honourable the long-established families of Rome think themselves to be, in reality, they are most likely descended from criminals, who are entirely without such honour. Either that or they are descended from farm workers. Juvenal's placing of the two 'professions' together and his obvious intention to prick the respectability of his target suggest that having an agricultural background is only marginally better than having a criminal one (Juvenal can, at least, get out the word *pastor*, where he would rather not mention the other type of person). There thus seems to be a great deal of potential shame associated with being connected to agriculture, and not just personal shame, but embarrassment for entire families. Juvenal's argument also tells us that agriculture was viewed as a feature of an older Rome. The city and its prominent families do have an agricultural past, but this was back in the distant realms of history, and here, it dates to the very foundation of the city. This is no longer what these families are known for, or connected with, and this applies to Rome as a city also.

The countryside was not always, however, seen as an awful, boorish place. Horace is one poet to, on occasion, sing the praises of leaving the urban environment.

[227] See also Livy i.8-9 on this.

At the end of *Satires* II.6, he famously adapted Aesop's story of the town mouse (*urbanus mus*) and country mouse (*rusticus mus*) (II.6.77-117), in which the town mouse, unimpressed with the offerings at the country mouse's home, invites the country mouse to dine at his opulent house in the city. Their extravagant meal is interrupted by an attack from Molossian hounds, resulting in the country mouse fleeing back to his own home, celebrating the calm safety of the countryside over the dangerous, raucous city. This fable in itself demonstrates a more positive view of country life – the countryside has advantages the city lacks, in terms of quiet liveability. The poem as a whole is devoted to this theme – that city life is busy and difficult (*Romae sponsorem me rapis.*… 'In Rome, you hurry me off to be a guarantor' (II.6.23); *aliena negotiua centum/ per caput et circa salient latus*… 'hundreds of other people's concerns flit through my head and around me…" (II.6.33-4)), while living in the country is calming, free from the interferences of politics, and allows one to partake of life's pleasures:

> *o rus, quando ego te aspiciam! quandoque licebit*
> *nunc veterum libris, nunc somno et ineritbus horis,*
> *ducere sollicitae iucunda oblivia vitae!*
>
> "O farm, when shall I see you? When will I be able
> to experience the sweet forgetfulness of life's cares,
> now with ancient classics, now with sleep and idle hours?"
> - *Sat.* II.6.60-3.

Horace here emphasises the disconnect between town and country not as a bad thing, but as a greatly advantageous feature. Being in the countryside allows one to forget work and pressures of the requirements of city life, and indulge in a more leisurely lifestyle.

We can thus see that there is a strong perceived divide between the urban and the rural in ancient Rome, and that rural life could be simultaneously viewed as both inferior and superior to life in the city. With this overview as a background, I want to turn now to consider some technical works, and how they present the urban/rural divide.

Education, Agriculture and Status

Here, I wish to focus on education and knowledge as one of the yard-sticks used by elite Romans to judge groups of people, and how this is seen to differ across the urban/rural dichotomy. In doing so, where astronomy lies within this divide will be

revealed and I will then use this, in the final section of this part of this thesis, to think about the weather in relation to education and status. I will begin with Pliny's *Natural History*.

When introducing his section on the basic principles of astronomy, Pliny makes the following claim:

> *Spes ardua et inmensa misceri posse caelestem divinitatem inperitiae rusticae, sed temptanda tam grandi vitae emolumento.*
>
> "It is an arduous and vast aspiration – to succeed in introducing the divine heavens to the ignorance of the rustic, but it must be attempted, owing to the vast benefit it confers on life." - *NH*.18.206

The urban man, this statement suggests, with his modern learning and scientific understanding of the world has much to teach the farmer about farming. This is an inversion of the relationship we would expect; surely a farmer would not need to be told how to do his job by some city-dwelling politician. But, of course, we have seen this view expressed before, in the form of the Julian Calendar reform. With that process, what was developed in a political and thus essentially urban setting, was applied theoretically on to the rural context of agriculture, as we witnessed in Varro's correlation of traditional stellar time reckoning and modern Julian dating.[228] There was clearly a view, then, that developments in agricultural practice needed to be driven by those who had the learning to advance it and thus that the urban-educated were deemed intellectually superior to the rural.

Indeed, education was an important social differentiator and mark of sophistication (and, in some cases, wealth) in ancient Rome. Theresa Morgan has highlighted this fact in her study *Literate Education in the Hellenistic and Roman Worlds*:

"Some of those who received a literature education will have come from highly cultured social groups, for whom reading and writing were part of life, even a vocation. Others will have hoped to break into such groups. Others again will never have hoped to write poetry or perform in festivals, but their literature will have given them a degree of status and a repertoire of Greek and Roman values which they might or might not incorporate into their everyday lives."[229]

Stanley Bonner noted similar features of Roman education, and drew, in a chapter appropriately titled 'Education in a decadent society', particular attention to the

[228] See above, page 163-4.
[229] Morgan (1999) 4.

view found in Roman society that education was an important tool of social mobility; to be one of the elite in society, you need to have had the appropriate education.[230] Level of education, the above passage from Pliny demonstrates, was also a factor that was seen to separate those who lived and worked in the country from those in urban settings, thus reflecting the inherent class inferiority of the rural populous.

The passage of Pliny quoted above is a good one for my purposes here, since it demonstrates not only this broad perceived intellectual division, but also a division based on astronomical knowledge in particular. Pliny picks out astronomy as a specific area of knowledge that is considerably more advanced and sophisticated amongst the urban elite than it is amongst the *rustici*. Similar sentiments are littered throughout book 18, all emphasising the same point – that the *rustici*, the 'country-dwellers', are *inperiti*, 'uneducated'.

As Taub has noted,[231] Columella too draws a distinction between 'rustics' and the astronomically-informed:

> *Novi autem veris principium non sic observare rusticus debet, quaemadmodum astrologus…*
>
> "But the 'rustic man' ought not to observe the beginning of spring, in the same way as the astronomer…" - *Rust.* 11.2.2

Columella here argues that farmers should not necessarily take a fixed astronomical event as indicating precisely when to perform certain tasks, in the way an astronomer would – they sometimes need to be more flexible than that systems would allow them to be. We can therefore once again see a distinction being made between 'rustics' and others on the grounds of education, and astronomical knowledge specifically. There is a pattern emerging here. It would appear that astronomy is a discipline that elite Romans would not associate with those living outside the urban centres; there is an assumption that farmers and alike are ignorant of astronomy and its application. That astronomy might be a significant defining characteristic in such a division should not surprise us, of course. After all, we have already seen how prominent and important star gazing had become in Roman culture and politics,[232] and that Cicero employs it as the paradigm of

[230] Bonner (1977) 101.
[231] Taub (2003) 39.
[232] See p.161-2 above.

an understood discipline[233]: its use as a marker of intelligence is thus perhaps somewhat expected.

We saw in the passage above that Pliny sees his collection of astronomical knowledge as being a potential help to farmers; educating them in astronomy will improve their lives. Columella's agricultural writing is clearly pitched somewhat differently – he is writing for an elite audience[234] and in so doing, reveals much about attitudes towards agriculture and rural life. Let us take a look at what Columella aims to achieve by writing the *Rei Rusticae*:

1. *Saepenumero civitatis nostrae principes audio culpantes modo agrorum infecunditatem, modo caeli per multa iam tempora noxiam frugibus intemperiem, quosdam etiam praedictas querimonias velut ratione certa mitigantes, quod existiment ubertate nimia prioris aevi defatigatum et effetum solum nequire pristina benignitate praebere mortalibus alimenta. Quas ego causas, Publi Silvine, procul a veritate abesse certum habeo…*

1. "Again and again I hear our leading citizens condemning sometimes the infertility of the soil, sometimes the inclemency of the climate for some seasons past, as harmful to crops; and some I hear reconciling the aforesaid complaints, as if on well-founded reasoning, on the ground that, in their opinion, the soil was worn out the exhausted by the over-production of earlier days and can no longer furnish sustenance to mortals with its old-time benevolence. I am certain, Publius Silvinus, such reasons are far from the truth…" (*Rust.*1.1)

2. *Quae cum animadvertam, saepe mecum retractans ac recogitans quam turpi consensu deserta exoleverit disciplina ruris, vereor ne flagitiosa et quodam modo pudenda aut inhonesta videatur ingenuis. Verum cum pluribus monumentis scriptorum admonear apud antiquos nostros fuisse gloriae curam rusticationis…*

2. "When I observe these things, often reviewing in my mind and reflecting upon the shameful unity with which rural discipline has been abandoned and become obselete, I am fearful lest it may be disgraceful and seem degrading or dishonourable to free-born men. But when I am reminded by many records of writers that to our ancestors it was celebrated to give their attention to farming…" (*Rust.* 1.13)

These two passages demonstrate to us that Columella has a fairly clear goal: to reverse the current opinion of elite Romans with regards to farming. He is aiming to demonstrate that agriculture is a worthwhile enterprise, because the fields around Rome are fertile (passage 1 above), and that involving one's self with farming is not shameful for elite Romans (passage 2 above).

[233] See p.184-5 above.
[234] See Thibodeau (2011) 35 n.49, with his appendix 2, pp.248-256.

Passage 1 above, the opening passage of the *De Re Rustica*, gives us some important indications as to general Roman attitudes towards agriculture. Crucially here, we can see that what Columella is resisting is the idea that agriculture is something that happened in the past. The fields had been worn out in an earlier time (*prioris aevi*), and their fertility is not what it once was (*pristina* 'former'). The rural life is apparently viewed as very much a relic of a former Rome.

The language of shame (*flagitiosa*; *pudenda; inhonesta*) used in the second passage above is strong in tone[235]; too close an association with agriculture would clearly result not just in mild social embarrassment, but genuine shame being brought upon the Roman in question. Columella is attempting to convince his readership that this does not have to be the case, that there is nothing wrong with agriculture. He attempts to fulfil his aim in two main ways: by giving examples of noteworthy honourable Romans who have concerned themselves with agriculture and by depicting agriculture as as much an intellectual activity as a physical one – to farm, one has to be intelligent.

For the first of these, Columella cites primarily the examples of Quinctius Cincinnatus (*Rust*. 1.13-15), who, according to tradition, was called up from his farm to take the dictatorship in order to save a besieged Roman army, and Marcus Varro, who, of course, wrote his own treatise on agriculture (*Rust*. 1.15-17). 'If such well-respected men were happy to concern themselves with agriculture, why should anyone feel shame for doing it themselves?' Columella is asking his readers. No doubt part of the potential shame would be from the association of farmers with ignorance, which we witnessed so evidently from Pliny's comments quoted above. Columella thus pays careful attention to how he portrays agriculture in the preface to his work:

> *Atque ego satis mirari non possum, quid ita dicendi cupidi seligant oratorem, cuius imitentur eloquentiam; mensurarum et numerorum modum rimantes, placitae disciplinae consectentur magistrum; vocis et cantus modulatorem, nec minus corporis gesticulatorem, scrupulosissime requirant saltationis ac musicae rationis studiosi;*
>
> *iam qui aedificare velint, fabros et architectos advocent; qui navigia mari concredere, gubernandi peritos; qui bella moliri, armorum et militiae gnaros; et ne singula persequar, ei studio, quod quis agere velit, consultissimum rectorem adhibeat;*

[235] *flagitiosa* and *inhonesta* appear to particularly evoke the idea of being shamed publically:
flagitiosa: is used by Cicero to attack the character of Verres at *Verr*.2.2.78 § 192 and to describe the actions of Catiline at *Cat.* 2.4.8.
inhonesta: used by Horace at *S.*1.6.36 of the shame of not knowing who one's mother is.

> *denique animi sibi quisque formatorem praeceptoremque virtutis e coetu sapientum arcessat: sola res rustica, quae sine dubitatione proxima et quasi sapientiae est, tam discentibus egeat quam magistris.*
>
> \- *Rust.* 1.3-5.

> "By I cannot wonder enough why those who wish to become speakers pick out an orator, whose eloquence they may imitate; those who investigate the science of surveying and mathematics emulate a master of disclipline they approve of; those who devote themselves to the study of dancing and music - and no less for a dancer - are most scrupulous in their search for one to teach modulation of the speaking and singing voice;
>
> even those who wish to build call on joiners and architects; those who would entrust ships to the sea send for skilful captains; those who make preparations for war call for men practised in arms and in campaigning; and, not to go through the list one by one, for any study which one wishes to pursue he employs the most expert guide;
>
> in short, everyone summons from the company of the wise man to mould his intellect and instruct him in the precepts of virtue; but agriculture matters alone, which is without doubt most closely related, and just as intellegent, is as lacking in student as it is in teachers."

I have divided this continuous passage into three sections to allow us to look at how Columella presents agriculture here.

In the first section, he begins by drawing our attention to tenets of traditional elite Roman education: oratory,[236] mathematics,[237] and those disciplines for which, despite some opposition, there were specific 'schools', namely dance and music,[238] and the fact that for these disciplines, people go out of their way to source the very best teachers they can. One, after all, needs instruction in these areas; one would not expect to be knowledgeable about them just from day to day life.

In the second section, Columella focuses on what we would perhaps now call 'applied knowledge' – building, sailing, campaigning. This is knowledge that is both too specialist for anyone to possess and that also be used to some sort of measurable (or indeed financial) end.

Finally in the third section, we reach to real point of this passage, a comparison between the disciplines already mentioned and agriculture, into which, Columella says, no one is putting any effort either to learn or to teach. This passage is clearly designed

[236] See Bonner (1977) *passim;* Morgan (1999) 190-239; Joyal, McDougall & Yardley (2009) 161-5, 203-6.
[237] See Bonner (1977) 78; Morgan (1999) 6-7.
[238] On which see Bonner (1977) 44, 57; Joyal, McDougall & Yardley (2009) 160-1.

to encourage Columella's readership to view agriculture, and agricultural education, as being just the same as these other disciplines and trades. Taking this message and using it to understand the the first section leads to the impression that agriculture is not only as intellectually rigorous as the education an elite Roman would receive, but that it is also as socially acceptable as that formalised education. Using it to read the second section leads us to think of agriculture as being, again, as specialist a body of knowledge as building, but also opens up the idea of agricultural knowledge being applied as a way of actually producing something, which is turn may result in financial gain. This final point, of course, stands to reinforce Columella's very first point, discussed above, about the fertility and potential yield of the Italian fields.

Indeed, Columella further draws comparison between subjects of traditional study and agriculture by focussing on the multitude of areas one needs to understand in order to undertake farming. At 1.1.22-28, he lists the fields of study one should know, including the weather, different soil types, astronomy, regional land variations, botanical knowledge, equine knowledge, bovine knowledge; the list is fairly lengthy. This technique, though, of expounding the magnitude of a subject is very typical of how Roman writers display the complexity of particular subjects. At *De Or.* 1.13-23, Cicero explains that studying oratory is difficult – one needs wit, humour, good linguistic knowledge, emotional insight and a good memory.[239] Vitruvius too, when describing the education of an architect at *De. Arch.* 1.1.3, reveals that an architect needs to be "skilful with a pencil, instructed in geometry, know much history, have followed the philosophers with attention, understand music, have some knowledge of medicine, know the opinions of jurists, and be acquainted with astronomy and the theory of the heavens".[240] By adopting this familiar technique, Columella highlights the complex intricacies of farming in a way that puts it on par with other disciplines that are similarly presented as intellectual and difficult. Crucially, though, he does it in a way that, since the same technique appears elsewhere, Romans evidently felt was an effective method of portraying the intellectual density of certain occupations.

Columella thus attempts to both gentrify and intellectualise agriculture to make it more appealing to his elite Roman readership. It is acceptable, he is arguing, for a

[239] There are larger parallels between the prefaces of these two texts. In the opening sections of *De Oratore*, Cicero too highlights the deficiency of the education of orators (1.1-5); that no one is focussing on becoming a great orator (1.6-12); and that studying oratory is difficult (13-23).
[240] *Et ut litteratus sit, peritus graphidos, eruditus geometria, historias complures noverit, philosophos diligenter audierit, musicam scierit, medicinae non sit ignarus responsa iurisconsultorum noverit, astrologiam caelique rationes cognitas habeat.* Vitruvius then goes on to explain each topics' relevance to architecture individually (1.1.4-11).

Roman to be involved with agriculture on intellectual, social and financial grounds. It is important that we keep this aim in mind as this section of the thesis continues.

Of course, the views of rural life and people that we are encountering here are stereotypes, idealised or imperfect, constructed by the Roman elite and incomplete truths. We have already seen by looking at Cato that there is often a disparity between the realities or ideals of farming and the urban view of it and similarly, we saw above that Columella is attempting to disprove incorrectly-held views, or stereotypes, of the countryside. Thibodeau has now expressed this idea by adopting the term *decorum*. He argues that Vergil's *Georgics*, but I think we can extend his thesis to apply to rural depictions more generally, is not primarily concerned with the practicalities of rural life, but with *decorum*, 'that which is suitable'.[241] In other words, when writing about, for example, agriculture, Roman authors tended to present their readers with, or exploit, the image of these people that they expect; the texts operated within or around the existing stereotypes. We will certainly see this played out below.

Having built up some idea of how rural life could be viewed by Roman writers, then, we must now turn to consider what relevance this has to understanding weather prediction in this period. In this next part I will argue that the increasingly separate methods of weather prediction fitted into the view of a dichotomised urban/rural division, some of which we have seen expressed above. I will suggest here that weather signs are typically deployed when wishing to convey a sense of rurality in a text, as seen in Lucan's *Pharsalia*, whereas when a certain amount of distance from the perception of rural life was required, astrometeorology could be used, which we will see in Columella's *De Re Rustica*.

(Un)Educated Weather Prediction

As a framework for reading these texts, we need to consider first a statement made by Pliny. We have already seen that Pliny expects no astronomical knowledge from the *rusticae*; it is something they have not been educated in. He made this same statement earlier, but that time with an additional piece of information about how those without a knowledge of astronomy might predict the weather. He begins by saying that the Pleiades can be used as an astrometeorological indicator, but that this is not how everyone would predict the weather:

[241] Thibodeau (2011) 40.

Sed ille indocilis caeli agricola hoc signum habeat inter suos vepres humumque suam aspiciens, cum folia decidere viderit…

"But our man the farmer, uneducated in astronomy, may find this sign amongst the bushes and by looking at his land, when he sees the leaves fall…"
- *NH.* 18.226

The division between the methods of prediction is a strong one here. Pliny is proposing that while the astronomically educated use astrometeorology, a farmer without that knowledge predicts by apparently looking for signifiers elsewhere – from his land, and plants.[242] This, I suggest, is a reference to the use of weather signs, indicating that there is an assumption amongst elite Romans that the uneducated *rusticae* and *agricolae* were using weather signs rather than astrometeorology to make their predictions. After all, if they have no astronomy, using weather signs is really the only other method available to them. This is the idea I will be testing in this section; the dichotomy of methods presented by Pliny is the *decorum* expected when discussing weather prediction. Is this assumption true of other authors too? And if so, what can this tell us about the methods?

With Pliny's comment in mind, let us move on to the *Pharsalia.* Above, I argued that the absence of astrometeorology from Amyclas' prediction in *Pharsalia* book 5 is deliberately highlighted by Lucan;[243] we are very clearly directed to notice the fact that he calls upon only weather signs. I would like here to suggest that this is an important part of Amyclas' characterisation, and that Lucan is calling upon perceptions of weather prediction methods and their cultural connections by featuring just one method.

Amyclas is depicted as an almost archetypal rural character. He is a sailor/fisherman (*rectorem dominumque ratis,* 'the skipper and owner of the boat' 5.515) an occupation which we have seen be used time and time again in connection with rural activities, he lives in a simple hut and sleeps on a bed of seaweed:

rectorem dominumque ratis secura tenebat
haud procul inde domus, non ullo robore fulta
sed sterili iunco cannaque intexta palustri
et latus inuersa nudum munita phaselo.
haec Caesar bis terque manu quassantia tectum
limina commouit. molli consurgit Amyclas
quem dabat alga toro…

"The skipper and owner of the boat had a secure house nearby, not supported by any timber, but woven from barren rushes and reeds and protected on its open side by an up-side-down boat. Caesar struck the threshold with his hand twice

[242] Thus demonstrating the same conceptual divide Alciphron did – see p.8 above.
[243] See pages 150-3.

and three times, shaking the roof. Amyclas rose from the bed which soft seaweed gave him…"

- 5.516-521

He is also cut off from the world of politics (*securus belli,* 'unconcerned with the war' 5.526). The decision to make him predict by weather signs alone is, I think, designed to feed into this characterisation. We have seen that Pliny casts this separation between those who predict by astrometeorology and those who use weather signs. We can assume from his occupation and house and his lack of politics that Amyclas belongs firmly in the 'weather sign group'; he presents many characteristics associated with the *rusticus*. It would have looked decidedly odd to a Roman audience had Amyclas produced a detailed prediction of the weather based on astrometeorological methods. Far more in-keeping with the idea of the rustic and the rural is having him predict by way of weather signs. This also gives us an explanation for why Lucan seems to focus so heavily on the lack of astronomy in this passage. It ensures his readers have definitely picked up on the fact that Amyclas is rustic through and through; he has none of the astronomical education that the Roman elite appear to view as a marker of status. As a result, I cannot agree with Monica Matthews. Amyclas' list of weather signs, she argues, is a "display of scientific knowledge".[244] This, I would suggest, is almost precisely what Amyclas' list is not; from the perspective of a Roman audience, Amyclas' prediction would come across as very deliberately not 'scientific', in as much as the predictions have very little grounding in scientific theory at the time in comparison to astrometeorology, as was demonstrated in the previous part of this chapter dealing with explanation. Weather signs, then, are deployed by Lucan as a way of reinforcing the characterisation of Amyclas, demonstrating an association between the rustic, embodied in Amyclas, and the use of weather signs.

We see the reverse side of this phenomenon played out in Columella's work. Where we have seen Lucan drawing his character closer to what was seen as 'typical' rural traits,[245] Columella is, as I have demonstrated above, attempting to do exactly the

[244] Matthews (2008) 118.

[245] Vergil, of course, is doing the same in the *Georgics.* His poem is not only consciously rural, but is also attempting to evoke and rekindle something of Rome's past (for more on the importance of Rome's 'rustic past', see Miles (1980) 3-11). I suggest that his chosen weather prediction techniques (described above, p.150 n.112) help achieve these. The agricultural calendar he employs would have certainly been viewed as out-of-date by his elite readership, for two main reasons: (1) The un-sophisticated nature of his astrometeorology, which operates a non-specific, broadly seasonal or part-yearly approach. This resembles the hints at the seasons we get in Cato's *De Agricultura* (see above, page 131-2) and is not a reflection of the technical developments that had occurred in astrometeorology, and that we have seen throughout this thesis. (2) The adoption of astral dating, rather than Julian. As Feeney (2007) 207 has noted, despite being nearly contemporary with Varro's agricultural writing, and thus post Julian Calendar

opposite and distance his agriculture from the stereotype. As we would therefore now expect, Columella's weather prediction stands in opposition to Lucan's.

I argued in the previous section of this chapter that Columella consciously excludes weather signs from his work. He uses a passage on the stars from Vergil's *Georgics* as his inspiration for discussing weather prediction, using astrometeorology, despite the relative absence of this method from Vergil's poem, which instead employs a lengthy passage on weather signs.[246] Columella's use of astrometeorology is, I suggest, designed to support his attempts to 'intellectualise' agriculture. We have seen above that astronomical knowledge could be used as a measure of one's education and that Columella was keen to depict agriculture as having intellectual merit. A predictive method that incorporated astronomy, then, would be the perfect thing to demonstrate these points, hence, I suggest, his preference for astrometeorology. The inclusion of weather signs would have perhaps undermined Columella's efforts since they were, as evidence from Pliny and Lucan shows us, viewed as a way to predict the weather for which an elite Roman education was not required. This view may have been particularly influenced by what we saw happening with regards the explanations of these two methods; with astrometeorology receiving a fairly unified explanation based on the influential ideas of stellar sympathy, and therefore part of modern scientific and astronomical theory, as thus a mark of elite intelligence, whereas weather signs were an assortment of information, some of which were explainable and some were not.

Weather signs, then, could be deployed by authors to suggest rurality in their work, while astrometeorology could be used to distance a text from rural stereotypes. The division we saw in Pliny's account, then, is certainly reflected elsewhere. Of course, the dichotomy of the predictive methods I have described here is, in reality, a false one; the texts all call upon the rural stereotype. We have seen from evidence as early as Hesiod that a knowledge of astronomy played a relatively large role in ancient farming from the very beginning. It is, however, evidently a pervasive enough stereotype that it reaches not only into agricultural writing, such as Columella's, but

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reform, we do not see Vergil attempting to correlate astral and Julian dates as Varro does. This further roots his poem not the in immediate present, but at some point in the past. This 'old-fashioned' agricultural calendar is paired with Vergil's lengthy account of weather signs. Taking into account the views of weather signs seen in this section, these signs would serve to strengthen the sense of rurality in Vergil's account and thus, because of Roman attitudes to agriculture, further enhance the idea that he is presenting aspects of a past Rome. Vergil, it must be noted, is exploiting the antiquity of agriculture in order to ennoble it – see Thibodeau (2011) 74-115.

[246] See pp. 149-150 above.

also appears in texts, and indeed genres, that, at first glance, reveal very little interest in rural settings or characters, like the *Pharsalia*.

Indeed, that there was a connection between rural pursuits and weather signs can even be seen, I think, where a Roman author is presented with the opposite to their stereotype. Above, I demonstrated that a divide operated in the depiction between farmers and sailors in Aratus' *Phaenomena*. Sailors, we saw, were largely seen to exploit astronomical information, and astrometeorology in particular, while farmers largely occupied the second half of the poem, make use of weather signs. When Cicero comes to write about sailors in his *De Divinatione*, however, he cites them, as we have seen numerous times throughout this chapter, as the paradigm of weather sign users. For examples of their signs, he quotes from his translation of Aratus' poem. It would appear, then, that when writing about the *Phaenomena,* Cicero did not acknowledge this divide, but instead simply extended the use of weather signs out from just the second half, to apply to sailing as well as farming. These predictions, as we saw above, are contrasted with predictions made using and about astronomical phenomena. This suggests that there must have been a sufficiently strong impression of rural life, that having a sailor predicting with weather signs, and that these signs are some distance away from astronomical signs, was a logical thing for Cicero to portray, and for his readers to see, despite the fact that Aratus credits sailors, exclusively in his poem, with knowledge of astronomy.

I do not want to suggest here that an elite Roman who noticed fleecy-looking clouds and suggested rain was approaching was ridiculed and mocked for his uncouthness. Rather, that weather signs did not carry the sense of learning and astronomical literacy that the Romans so admired and which could be used as a mark of social status; astrometeorology, however, could provide those things. As a result, weather signs are shown as belonging within the rural sphere, in which education was not available. Therefore, just as the Julian Calendar reform was a high-profile endorsement of astrometeorology, this section represents the flip-side to that process. If one method becomes increasingly respected and used, the other is increasingly left behind and becomes viewed as out-of-date and unsophisticated, just like rural life itself could be.

How the two methods are deployed within the urban-rural dichotomy in the texts discussed here thus supports, and partly explains, the narrative I constructed above

concerning the depiction of a increasing reliance on astrometeorology and rejection of weather signs.

6. Conclusions

This final part has described the state of weather signs in the literature of the Roman world to the end of the 1st century AD. We have witnessed a move from presenting predictions made by weather signs as being trusted, albeit hesitantly, to them being consciously ignored by texts concerned with weather prediction; they appear to have rapidly moved from being depicted as predictors with some degree of usefulness to being viewed as relics of a former Rome. Astrometeorology in this period, however, became more sophisticated and much more closely integrated into Roman private and political life. With this increasing difference in the methods, came, I have argued, an ever more entrenched division between them, resulting in the inclusion of one method in a text sometimes preventing the inclusion of the other.

I suggested three potential reasons for this increasing separation, and the opposite directions in which the depicted utility of the two methods moved. One of these reasons was a continuation of a theme we saw develop in the earlier Greek sources – explanation. Like the Greek authors, Roman authors struggled to explain the phenomenon of weather signs, and we thus saw them discussed in increasingly ambiguous ways, employing imprecise, vague language. Astrometeorology, however, still had two full explanations, one causal and one temporal, and thus the questions that seem to hang over passages of weather signs in Roman text are just not present in those concerning astrometeorology. While this appeared to be a doubt that the Romans inherited from their Greek sources, I also suggested some uniquely Roman reasons for the favouring of astrometeorology.

The first of these was the Julian Calendar reform. This reform allowed weather prediction to be integrated into the official calendar of Roman state business. This prediction, though, was in the form of astrometeorology and meant that this method received not only high-profile endorsement, but also a streamlined application alongside one's calendar dates. The meteorological aspect of the Julian Calendar reform has been sorely overlooked in recent scholarship, and was in need of being reaffirmed in this way.

I also suggested that a strong social divide had a role in defining the level of respect applied to each of the prediction methods. Knowledge of astronomical disciplines were viewed as a mark of high status and at the same time, an association with the practice of agriculture was to be avoided at all costs, lest it tarnish one's family name. Weather signs, with their un-scientific reasoning, became associated with such rural pursuits, while astrometeorology can be viewed as embodying much that was admired, crucially revealing education and knowledge. This is in strong contrast to the Greek use of weather prediction, where the two methods were not so harshly divided. This demonstrates not only the increasing separation I have argued for, but also that the Romans did have their own way of thinking about and describing weather signs; they did not slavishly follow Greek ideas and depictions. That knowledge of the weather can be used as a way of accessing discussions of status and education has not been explored prior to this thesis, and opens up the potential for further study on the relationship between science and status.

These two reasons are linked by the growth in popularity and prominence of the stars in Roman politics. As they become more influential in a range of ways, so astrometeorology had a fast-track to trust and respect. How could weather signs possibly have competed?

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Over this thesis as a whole, then, I have attempted to construct a history of weather signs in antiquity and more specifically, a history of their changing presentation as seen through their relationship with astrometeorology. I have argued that up to the end of 1st century AD, we can see weather signs being increasingly sidelined as a predictive method. Instead, astrometeorology is presented as the most relied-upon, trustworthy method. Where once, with Hesiod, natural signs were included in his work as indicators of the time of year and the weather, and were used interchangeably with astronomical observations, by the 4th century BC the two methods had become intellectually distinct from one another, and astrometeorology had begun to dictate how weather sign lists were constructed and thus how the signs in those lists could have been used. This primary/secondary, but still connected, relationship appears to have persisted until the mid-1st century BC, when Geminus and Cicero alike attest to the usability of both methods. The Julian Calendar reform of 45/44 BC was, I have suggested, an important turning point. After this, we see the methods as heavily dichotomised and by the time Pliny the Elder was writing, they had lost their time-reckoning function many centuries

ago, and come across as an outmoded method of weather prediction, replaced instead by the increasingly sophisticated and detailed predictions made by astrometeorology. In doing so, I have consistently shown throughout that how weather signs were written about was heavily affected by developments, both technical and social, in astronomy.

Wherever, then, the assumption is made that the ancient Greek and Roman texts reflect the fact that they straightforwardly 'used' weather signs to make their predictions, this must now be heavily qualified to state that this was by no means the only method, or perhaps even their main method, of prediction. Weather signs were viewed very sceptically in antiquity, and their accuracy and reliability was frequently called into question.

We have seen that there was some intellectual and scientific interest in weather signs and especially in how they worked, though this is frequently quite cursory; weather signs appear to have been only right on the very edges of such investigations. In both the Greek and Roman treatments, authors struggle to produce explanations to account for all the signs. This effort did not stop, and we know that Plutarch wrote a work dealing with explanations of Aratus' signs, and that the scholiasts to the *Phaenomena* offer explanations for some of the signs also.

There was certainly much continuity between the Greeks and Romans with regards to weather signs; many of the same signs were used across both cultures, the structure of Greek lists evidently influenced Roman lists, and, as I have shown, certain concerns surrounding weather signs, such as accuracy and the issue of explanation, would appear to unite the two. But I have also attempted to show that reading Roman weather signs and sign lists as being simply identical to Greek ones, as has been standard in the scholarship, is a troublesome approach. The sign lists were assimilated into Roman thought in a particularly Roman way through comparison with portents, which meant that where the Greeks had viewed weather signs as something basically 'scientific' (although right at the edges of such discourse), the Romans saw them as far less securely characterised in this way.

Weather signs also denoted different social characteristics across the two cultures. The Roman deployment of them, in contrast to the use of astrometeorology, reveals a varyingly subtle undercurrent of rurality to weather signs, something that we do not find in the Greek evidence. More generally, then, I have hoped to show that whether they were invoking literary motifs, bringing philosophical and scientific questions to the fore, or displaying contemporary attitudes to, or evidence of,

knowledge, something as seemingly innocuous and 'everyday' as the appearance of weather prediction in ancient texts, can carry significance, and be laden with ideas, far beyond the simple 'this is a way to predict the weather'.

Scholarship on weather signs has had a tendency to do two things: to over-simplify weather signs and to see their inclusion in texts as 'just another list of signs', while paradoxically giving them too much credit – thinking that they are depicted as trusted and accurate enough to operate as a stand-alone system throughout antiquity. I have attempted to demonstrate that they actually operated within a much larger scientific and social context and that they frequently interacted with a range of other areas of study and interest. Their depiction and presentation in ancient writing, I have suggested, was effected by, while also contributing to, wider discussions of not only weather prediction but also meteorology more generally and questions of how the natural world was constructed and understood. Ironically, though, ancient study and consideration of them played a substantial role in their eventual demise and the production of criticism to be levelled against them. In many areas, they were found to be lacking or deficient and as a result, were gradually relegated to being thought of as, much as they are now, interesting small facts of dubious accuracy and source.

Appendix: On Posidippus, *Epigrams* AB 21-3

I have chosen to exclude from this thesis three epigrams by the Hellenistic poet Posidippus. The epigrams were part of a newly discovered set of poems found in the late 3rd century BC 'Milan Papyrus' (P. Mil. Volg. VIII 309) and were published in 2001.[1] The papyrus contains a total of approximately 112 epigrams, all of which are organised into titled groups.[2] The epigrams in question here appear in a section entitled Οἰωνοσκοπικά, literally 'bird-observation', but perhaps more specifically 'omens'. Owing to the short time for which scholars have had these poems, there is little in the way of scholarship on them. In the few articles that have been published, though, there has been a tendency to categorise and describe, to varying degrees, AB (Austin and Bastianini) 21-3 as weather signs or as containing weather signs. I will here argue against that view and demonstrate that the evidence is not sufficiently strong for them to be considered as weather signs. It is not my intention here to attempt to place them within the Posidippan corpus as a whole, or even consider them in relation to one another in any detail; my interest lies solely with whether or not these three epigrams contain weather signs. I will begin by giving a brief overview of the current scholarly positions on this issue.

David Sider is the staunchest advocate of reading these epigrams as weather signs. In his article,[3] he proposes reading all three epigrams as poeticised weather signs, primarily by looking for parallels with other weather sign texts and is thus reflects the recurring approach in weather sign scholarship of source-criticism solely within the weather sign literary tradition itself.[4] Manuel Baumbach and Kai Trampedach have a much less unified idea about the generic affiliations of the epigrams, and thus tentatively suggest a weather sign reading for just one of the epigrams, AB 22.[5] Donald Lavigne and Allen Romano's article is the final work of note here. They are less interested in establishing categories of bird signs, and so simply mention in passing that the birds in both AB 21 and 22 have documented roles as weather signs.[6]

Epigram 23 can be fairly straightforwardly be demonstrated not to be a weather sign, and so can be dispatched with first. The text and translation is given below:

ἠερίην αἴθυιαν ἰδὼ[ν ὑπ]ὸ κῦμ[α] θαλάσ[σησ]

[1] In Bastianini, Gallazzi and Austin (2001). A further edition appeared as Austin and Bastianini (2002), from which the texts here are taken.
[2] Whether these groupings are by the original poet or not is unknown; see Gutzwiller (2005) 3.
[3] Sider (2005).
[4] For more on this, see my comments above, pp.17-18.
[5] Baumbach & Trampedach (2004) 151-2.
[6] Lavigne & Romano (2004) 16, with n.17; n.22.

δυομένην, ἁλιεῦ, σῆ[μα φ]ύλα[σ]σ᾽ ἀγαθ[όν·]
καὶ πολυάγκιστρον κ[αθίει] καὶ βάλλε σαγ[ήνην]
κ]ᾳὶ κύρτους· ἄγρης οὔ[ποτ᾽ ἄ]πε[ι] κενεός.

Catching sight of a shearwater[7] as it dives in the morning
Under the waves, consider it, fisherman, a good sign.
[Let down] a line full of hooks and cast both drag[net]
And traps: you will not go home empty-handed.[8]

Sider argues that "the diving shearwater signals rain…, a good sign for an [sic] fisherman".[9] As evidence of this, he cites this same sign appearing in chapter 28 of the *De Signis*. He offers no explanation for why a fisherman would want rain. This interpretation, though, is surely to over-read the epigram a little. The diving shearwater is a good sign to fishermen not, I would suggest, because of its significance as a weather sign, but because, as the last line of the epigram tells us, it ensures a good catch. How is this so? Because the shearwater is a bird that dives in order to catch fish, seeing it dive indicates that fish are present. Indeed, such behaviour is noted in the 2nd century AD text *De Aucupio* by Dionysius (2.6), where the bird's fondness for oily fish is also described. For a good catch, fishermen need fish, and the shearwater shows them where to find them.[10] Baumbach and Trampedach seem right, then, in characterising this epigram as a "country-saying", rather than a weather sign specifically.[11]

Epigram 21 can be next to receive attention:

νηῒ καθελκομένηι πάντα πλέος ἰνὶ φανήτω
ἴρηξ, αἰθυίης οὐ καθαροπτέρυγος·
δύνων εἰς βυθὸν ὄρνις ἀνάρσιος, ἀλλὰ πετέσθω
ὑψο..[.....]..[....].[..].φ᾽ ὅλως·
οἷος ἀπὸ δρυὸσ ὦρτ᾽ Ἰακῆσ ὠκύπτερος ἴρηξ
ἰρῆι, Τίμων, σῆι νηῒ καθελκομένηι

At a ship's launching, let a hawk appear in all its power,
As the shearwater's wings are not of good omen.
A bird diving into the deep bodes ill, but if it soars
Into the sky [… … …] all the way.
So from that oak in Ionia darted a swift-winged hawk
At the launching, Timon, of your sacred ship.

This epigram juxtaposes the appearance of two birds at the launching of a ship: one hopes for a hawk, ἴρηξ and not a shearwater, αἰθυία. Once again, Sider reads this epigram as containing

[7] This bird is typically associated with the shearwater though, as Arnott has pointed out, there appears to have been little effort to distinguish between types of seabirds in the ancient world: Arnott (2007) 12.
[8] The Posidippus translations here are those of Nisetich, in Gutzwiller (ed.) (2005), with some minor alterations.
[9] Sider (2005) 174.
[10] Lavigne and Romano (2004) 17 also favour this explanation.
[11] Baumbach & Trampedach (2004) 152.

two separate weather signs. The hawk, he suggests, citing a parallel from Dionysius' *de Aucupio* 2.9, can read the direction and force of the wind, and is thus a useful sign for the launching of a ship. He does acknowledge, however, that at *De Signis* 17, a hawk can also signal rain.[12] The comparative evidence for the hawk as a weather sign is thus not particularly strong. Both Lavigne and Romano, and Baumbach and Trampedach read this hawk not as a weather sign but as a traditional omen, and perhaps even a personification of Poseidon.[13] This is owing to the fact that at *Iliad* 13.62-70, Poseidon is likened to a hawk, and the Posidippus epigram shows a close intertextual vocabulary link with that passage.[14] The hawk thus indicates divine favour bestowed upon the launching ship. As for the shearwater, Sider reads the hapax καθαροπτέρυγος here as indicating the process of the shearwater washing its wings.[15] As a result, he looks to the numerous appearances of a shearwater washing and flapping its wings as a sign of wind, and potentially a storm.[16] This reading, however, seems more to be driven by the desire to interpret this epigram as a weather sign rather than any linguistic precedent. Lavigne and Romano offer a fine alternative: the shearwater is "not clear-winged".[17] The meaning, then, does not have to refer to the specific act of the bird washing its wings, but could refer to the generally unclean state of a shearwater's wings. Alternatively, Austin and Bastinianini, in their translation, quoted above, appear to take the καθαρο- as not referring to the (un)cleanliness of the actual wings, but the negative nature of the birds significance.

It is true that the shearwater has a long history as a weather sign, so readings such as Sider's are understandable, however, this does overlook the fact that the shearwater has an existing link to shipwrecks; due to their diving action, there are numerous instances of authors describing sinking ships as being like shearwaters.[18] I would suggest that the fact that the diving action is explicitly referred to (line 3), and juxtaposed with upward soaring (line 3-4),[19] in this epigram suggests that Posidippus had this notion in mind, not a weather sign. The shearwater here is thus the counterpoint to the hawk in that they are both prophetic omens – one of success, one of failure – and not weather signs. Birds were, of course, a prominent part of Greek divination and this use is therefore not surprising.[20]

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[12] Sider (2005) 167.
[13] Baumbach & Trampedach (2004) 153; Lavigne & Romano (2004) 16.
[14] As shown by Baumbach & Trampedach (2004) 152-4.
[15] Sider (2005) 21.
[16] For example *De Signis* 28, *Phaenomena* 918-19, Pliny *NH.* 18.362; Sider (2005) 167-8.
[17] Lavigne & Romano (2004) 16.
[18] For example, Aratus says sailors in a storm are like this bird (*Phae.* 296) and Callimachus *h.Del.*12, compares a ship-wrecked man to this bird. Thompson (1936) 28-9 gives a full list of these parallels.
[19] As Lavigne & Romano (2004) 16 have noted.
[20] For birds in Greek divination and mantic practice, see Halliday (1913) 246-71; Pollard (1977) 110-29 and, with particular reference to this epigrams, Baumbach & Trampedach (2004) 137-150.

Finally, epigram 22:

ὄρνις μὲν β[ο]υκαῖος ἐπήρατος ἀνδρὶ γεωργῶι
φαινέσθω, λ̣ή̣π̣τ̣ης καὶ περὶ φύτ̣λ̣’ ἀ̣γ̣α̣θ̣ό̣[ς·]
ἡμῖν δ’ Αἰγύπτου πέλαγος μέλλουσι διώκειν
Θρῆισσα κατὰ προτόνων ἡγεμονέοι γέρανος,
σῆμα κυβερνήτηι καταδέξιον, ἢ τὸ μέγ’ [ἀθρεῖ]
κῦμα, δι’ ἠερίων σω[ιζο]μένη πεδίων.

Let the wagtail appear to the husbandman’s delight,
A good fly-catcher even amongst the plants.
But as we are about to sail over the Egyptian sea,
May the Thracian crane, along the forestays, guide us on our way,
A favourable sign for the pilot, as [it observes] the great
Wave, safely gliding through the high expanses of air.

The bird in this epigram is simply described as ὀρνις βουκαῖος, a ‘herdsman bird’, but its identification as a wagtail is well established.[21] As Sider notes, this is such a common bird that its appearance would be so frequent as to render it useless as a predictive sign.[22] As such, the wagtail does not feature in any extant weather sign lists. “If only”, he states, “it could be shown to be a σπίνος, a finch”,[23] which does a role as a weather sign. This, however, is pure speculation on Sider’s part and does not seem possible. Searching for a particular significance of a wagtail, though, seems to once again rather ignore what we are actually told in the epigram. λήπτης here has been interpreted as meaning that the bird in question is a ‘fly-catcher’. I would suggest, then, that their importance to farmers and why they are good for plants is not that they signify a particular weather type, but that they eat potentially harmful insects from around plants (and thus presumably useful crops also).[24] Turning to the crane of this epigram, we are told that it is beneficial to captains of boats (line 5). Unlike the wagtail, the crane does have an established role as a weather sign.[25] The mention of the Egyptian sea (line 3) and the description of the bird as Thracian (line 4) make it clear that we should have in mind the crane’s migratory patterns, from northern Europe to Africa,[26] which are themselves meteorologically significant – the return to Europe being a traditional sign of the start of winter, and of bad weather.[27] But it does not seem to be the meteorology that is important here; it is the bird’s role as a kind of guide that is focussed on, through the use of

[21] Indeed, Thompson (1936) 65 notes the use of this terminology for a wagtail, explaining that they were known to fly in fields that contained cows in order to catch the flies that accompany them.
[22] Sider (2005) 171.
[23] Sider (2005) 171.
[24] For an account of this, see Washburn (1918) *passim*, but especially 372.
[25] For example, at *DS*.38, 42; *Phae*. 1075; also, migratory cranes and the seasons are linked in Hesiod, on which see pp.34-5 above.
[26] As Sider (2005) 172 notes. For details of the crane’s migration, see Thompson (1936) 71-2.
[27] See Sider (2005) 172.

the verb ἡγέομαι (line 4). This is because, we are told, cranes know how to achieve safe passage on this journey. It was known in antiquity that a crane would deviate its usual straight course to avoid bad weather,[28] but the real debate here is whether the ἡγεμονέοι is literal (as in, the sailors would follow the course of the crane to navigate successfully[29]), or poetic (the crane is a 'guide' in that changes to its course indicates upcoming storms, so sailors can prepare for it[30]). The meaning is ambiguous here, and there is no corroborating evidence to prove either argument.[31] My personal inclination is that even if the use of the birds has a meteorological underpinning, the emphasis in this epigram is on their utility as navigational aids; I would take the 'guide' more literally than Sider is willing to. The bird may change course due to an approaching storm, and a sailor may follow suit. The epigram does not deal with weather prediction *per se*, but does discuss sailing.

The above readings of the birds contained in these epigrams lead me to conclude that there is sufficiently good evidence for not taking them to be weather signs. In each instance, the inclusion of the birds as 'signs' can more readily be accounted for in ways other than their significance to the weather, explicit reference to which is absent in each case.

[28] See Aristotle *HA.* 614b19-21 with Sider (2005) 173.
[29] This is how Austin and Bastianini appear to take it.
[30] As Sider (2005) 173 has it.
[31] The issue is not discussed in Taub (2011). There do exist parallels for this type of navigation. One cannot help but see parallels with the birds used for navigation by Viking settlers, in which ravens were taken on board and released at intervals to allow them to fly to land; the ships then followed their direction of travel. On this, see Hornell (1946) 145-6.

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